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THE JOURNAL

OF THE

CINCINNATI

Society of Natural History.

Publishing Committee.

JAMES W. ABERT, A. P. MORGAN,
GEO. W. HARPER, DAVIS L. JAMES,
WALTER A. DUN.

JULY, 1884.

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* Omitted from the Table of Contents on cover of the April number.

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THE JOURNAL

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Cincinnati Society of Natural History.

VOL. VII. CINCINNATI, JULY, 1884. No. 2.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *April* 1, 1884.

ANNUAL MEETING.

President Hunt in the Chair. Twenty-eight members present.

The minutes of the Executive Board for January, February and March were read.

The Treasurer, Mr. S. E. Wright, read his report for the year ending April 1st.* The report was received and referred to an Auditing Committee, consisting of Dr. R. M. Byrnes, Davis L. James and Dr. W. A. Dun.

The reports of Dr. O. D. Norton, curator of Botany; Mr. Wm. Hubbell Fisher, curator of Ornithology; Dr. A. E. Heighway, Jr., curator of Herpetology; Dr. A. J. Howe, curator of Comparative Anatomy; Mr. E. M. Cooper, curator of Conchology; Prof. J. W. Hall, curator of Mineralogy; Dr. A. E. Heighway, Jr., Librarian, were read.

The Custodian, Prof. Joseph F. James, read his annual report upon the condition of the Museum.

The reports were received and referred to the Committee on Publication.

The amendment to the By-Laws proposed at the preceding meeting was read.†

Dr. Walter A. Dun moved an amendment to the amendment as follows: by adding to the amendment proposed the following words: "And a non-member shall not be allowed to read a paper before this Society unless

* This, and the other reports mentioned below, will be found in another part of this journal.

† See page 4 of present volume.

especially invited to do so by the Society or the Executive Board." The motion was seconded by Mr. Skinner.

There being objection to the passage of this amendment without lying-over for one month, on the ground of its embodying a new proposition Dr. Dun withdrew his motion with the consent of his second.

The original amendment to the By-Laws was then unanimously adopted.

Dr. Dun then offered the amendment as above written, and it was laid over for action at the next meeting.

The Society then went into an election of officers, to serve for one year. The following persons were elected to fill the offices set down opposite their names:

President, ...	Dr. J. H. Hunt.
First Vice-President, . . .	Prof. Geo. W. Harper.
Second Vice-President, . .	J. R. Skinner.
Secretary, ...	Davis L. James.
Treasurer, ...	S. E. Wright.
CURATORS.	
Paleontology, ...	E. M. Cooper.
Botany, ...	Miss Sarah C. Stubbs.
Ornithology, ...	Wm. Hubbell Fisher.
Icthyology, ...	Dr. D. S. Young.
Anthropology, ...	Dr. W. A. Dun.
Comparative Anatomy, . . .	Dr. A. J. Howe.
Herpetology, ...	A. E. Heighway, Jr.
Mineralogy, ...	J. W. Hall, Jr.
Conchology, ...	Mrs. M. C. Moorehead.
Entomology, ...	Charles Dury.

Members at large of the Executive Board: Col. J. W. Abert, Dr. W. A. Dun, A. P. Morgan, E. M. Cooper.

Trustee for two years: Julius Dexter, Esq.

Donations were received as follows:

From the U. S. Fish Commission, Reports for 1872-3, '79-80; from Ottawa Field Naturalist's Club, Transactions No. 4, 1882-3; from Davis L. James, Annual Report Rochester Society of Natural History, Dec. 1883; from Bureau of Education, Washington, Circular of Information No. 3, 1883; from Chief Signal Service Officer, Weather Review, January, 1883; from Theodore Gill, Washington, D. C., Principles Zöogeography; from Dr. E. G. Betty, Portrait of John L. Talbott; from Secretary of the American Institute of Mining Engineers, Proceedings of Annual Meeting, Cincin-

nati, February 19, 1884; from Allen M. James, two specimens marine shells; from E. M. Cooper, one malformed hen's egg; from Dr. W. A. Dun, two coccoons.

Adjourned.

TUESDAY, *May* 6, 1884.

SCIENTIFIC MEETING.

President Hunt in the chair. Fifteen members present.

Prof. Joseph F. James read a paper on "Pollen, its development, forms and uses." The subject was prefaced by an account of the courses of instruction for teachers and advanced students which are now afforded by the large Museums and Academies of Science in the Eastern cities. The paper was fully illustrated with pictures prepared by the author and projected upon a screen, Dr. Hunt assisting with the lantern.

The paper was referred to the Publishing Committee.

The committee appointed at the annual meeting to audit the Treasurer's accounts, reported as follows:

CINCINNATI, *May* 2, 1884.

To the President and Members of the Cincinnati Society of Natural History:

Gentlemen—Your Committee appointed at the annual meeting April 1, 1883, have examined the report of the Treasurer, Mr. S. E. Wright, for the year ending April 1, 1884, and find the same to be correct; and would most heartily commend the manner in which the accounts are kept. They also congratulate the Society upon being favored with the gratuitous services of so faithful and efficient an officer.

Respectfully submitted,

R. M. BYRNES,
DAVIS L. JAMES,
WALTER A. DUN,
Committee.

The report was received and the committee discharged.

The amendment to the By-Laws, submitted at the April meeting by Dr. Dun, was unanimously adopted.

Donations were received as follows:

From Bureau of Education, Washington, Circulars of Information No. 5, 1873, No. 1, 1884, Report of Director of American School of Classical Studies, at Athens. 1882-3; from W. H. Linney, two Geological Maps of Spencer and Garrard, and Mercer and Garrard Counties, Ky.; from Davis L. James, Report of Superintendent of Coast Survey, 1852; from Chief

Signal Service Officer, Weather Review, February, 1884; from Smithsonian Institution, Proceedings of U. S. Nat. Museum, Vol. VI, Nos. 24, 25, 26; from Sam'l Garman, Cambridge, Mass., List of N. American Reptiles and Batrachians; from H. C. Stewart, one specimen hornet's nest; from Dr. A. J. Howe, one fossil; from U. P. James, five species fossil corals—types of M. circularis, James, M. welchi, James, M. communis, James, M. dychi, James, Fistulipora oweni, James; from Col. J. W. Abert, specimen of pulverized gold ore.

TUESDAY, *June* 3, 1884.

SCIENTIFIC MEETING.

Col. J. W. Abert, Chairman, pro tem. Sixteen members present.

Mr. E. M. Cooper read a paper entitled "Some Curious Animals," and exhibited a series of photographic lantern pictures in illustration of his subject. The pictures were prepared by Mr. Charles N. Woodward and were donated to the Society's collection.

Mr. Woodward received a vote of thanks for his gift.

Prof. Joseph F. James remarked upon variations of Trifolium pratense. The text-books describe it with sessile heads and spotted leaflets. He had observed it frequently with peduncled heads and spotless leaves. He also presented the Society with thirty (30) species of plants, mounted and named, as the nucleus of a collection to embrace the Flora of Cincinnati. He desired members who might come into possession of rare or fine specimens to send them to the rooms, where they would be dried, mounted and placed in the herbarium, with proper acknowledgment.

Mr. Davis L. James exhibited specimens of the White Water-Crowfoot, Ranunculus aquatilis, a plant which has been considered scarce in this region. The specimens were from near Glendale.

Dr. R. M. Byrnes said that he had that afternoon seen specimens from Ross Lake, where he had been told it is quite abundant.

A paper by Mr. U. P. James was read by title as follows: "Description of four new species of Fossils from the Cincinnati Group." The paper was referred to the Publishing Committee.

It was announced that the Curator of Botany wished to establish a Botanical Section, and Saturday, June 7, was named as a day for a meeting for the purpose.

Dr. Heighway offered to present the Society a collection from the Yellowstone Geyser region, if it would provide a case for it.

The Society thanked the Doctor for his offer and referred the matter to the Executive Board.

Donations were announced as follows:

From the U. S. Fish Commission, Bulletin, Vol. iv, Nos. 1, 2, 3, 4, 5, 6, 7, 8; Chief of Engineers, Washington, Reports on Preservation of Timber, Building Stones, of Explorations in Nebraska and Dakota in 1855-1856-1857, by Lieut. Warren, of Reconnaissance from Carroll to the Yellowstone, in 1875; from Mrs. M. C. Moorehead, thirteen species of shells; from Museum of Comparative Zoölogy, Cambridge, Hamlin on Syrian Molluscan Fossils; Signal Service Bureau, Monthly Weather Review, March, 1884; from Otis T. Mason, Washington, D. C., Notes on Anthropology for March, April and May, 1884; from Entomological Society of Ontario, Report for 1883; from Smithsonian Institution, Proceedings U. S. National Museum - Sigs. 27, 28, 29, 30, 31; from Edward M. Cooper, Proceedings of the Worcester Society of Antiquity for 1883; from Miss Marie Mohr, large collection of dried plants from Alabama, Ohio and Europe; from Jos. F. James, thirty-one species of mounted plants, as a nucleus for a Cincinnati Herbarium; from Dr. R. M. Byrnes, two specimens Cardamine diphylla; from Jos. F. James, two species seeds; from W. Andrew, one fossil; from Dr. J. H. Hunt, two magic lantern pictures; from C. N. Woodward, 22 lantern pictures; from U. P. James, one snake.

REPORTS OF CURATORS
AND
THE CUSTODIAN,

For the Year ending April 1, 1884.

Cincinnati, O., *March*, 1884.

To the President and Members of the Cincinnati Society of Natural History:

Gentlemen— The additions to the collection of Mineralogical specimens have not been large during the past year. We have had one exchange by which some twenty new species have been secured. The total addition was seventy-five specimens. I have lately been maturing a plan, and in furtherance of it have been in correspondence with Prof. A. E. Foote, of Philadelphia, and Ward & Howell, of Rochester, by which we can have a good set of rocks scientifically arranged, classified and labeled. Our minerals, as a general thing, are good, and fairly classified and labeled, but

our rocks are not. These are now, in all well regulated cabinets, placed separately from the minerals proper. We have room in our present cases for a much larger number of species of minerals by taking out the duplicates and placing them on the exchange list. I am making out a list of what we need to make our collection a profitable one for our young folks to study as well as attractive to our citizens and stranger visitors. When complete I shall present it, with the probable cost, and hope that our Honorable Board will furnish the amount requisite for the purchase.

Yours, very truly, J. W. Hall, Jr.,
Curator of Mineralogy Cin. Soc. Nat. History.

Cincinnati, O., *April*, 1884.

Gentlemen of the Cincinnati Society of Natural History:—Enclosed with my Annual Report you will please find the following supplementary suggestions which, if acted upon favorably, will add very materially to the value of our collection as well as interest. I have spent considerable time and care in making a selection of rocks which will show each formation from Archæan to recent, and have them stratagraphically arranged. I find that Ward & Howell have precisely the specimens we want, and they will send 100 specimens, carefully labeled, with formation and locality, and on blocks. We also need very much a *lithological* series of rocks, which will contain not only the rocks that will likely be met with by ordinary observers, but characteristic and typical rocks of the most important varieties. This series will contain 100 specimens, located and named properly. This series will cost about $45 and the first $50; total $95, for 200 specimens I intend to rearrange the whole collection if these series are granted as a basis. In the rearrangement I will select specimens and make a separate collection illustrated; 1st, Structural and Phenomenal Geology, with the following divisions: "Varieties" of Structure, Concretionary, Cellular, Porphyritic, Stratified, Texture, Veins, Metamorphism, etc.; also, 2d, another case showing tests of minerals, as Lustre, Color, Dichroism, Diaphaneity, Refraction, Polarization, Cohesion, Aggregation, Form and Crystallography. I shall be happy to meet with any committee and explain more fully my plan and how it can be done with comparatively little expense. We need to have our collection in all departments not merely *deposited* for *safe keeping*, but it should be arranged so as to have a scientific and educational value. With the suggestions offered I think we can have a valuable change, not to be estimated on a money basis. Yours, very respectfully, J. W. Hall,
Curator of Mineralogy, C. S. N. H.

CINCINNATI, *April* 1, 1884.

CINCINNATI SOCIETY OF NATURAL HISTORY:—The department of Conchology is one of the most attractive in our Museum, and while the additions to the collection during the past year have been comparatively few, being some twenty-five species only, still a number of these have been rare and attractive; amongst the number being the rare and valuable species Voluta junonia, kindly presented by Mr. T. H Aldrich. A great number of specimens still remain undisplayed—this being specially true of the Lamellibranchs, and particularly of the Freshwater Shells—the cause being a lack of case room. In my report last year I urged upon the Board the necessity of additional case room for the display and care of these interesting and attractive specimens, and I would again respectfully request the purchase of either additional flat cases, such as we now have, or of drawers with glass tops, as are used in the Philadelphia Academy. Our library also lacks books of reference on the subject of Conchology, and a small sum might be judiciously expended in purchasing such books as would not only assist the custodian, but prove of value to the members.

Respectfully, ED. M. COOPER,
Curator of Conchology.

CINCINNATI, *April* 1, 1884.

MR. PRESIDENT:—The undersigned begs leave to report that during the past year very valuable additions have been made to our splendid Herbarium, which has been very carefully arranged according to Bentham & Hooker's sequence of orders, affording complete facility for the ready examination of the specimens which now number nearly 3,600 species; a large collection of seeds and a fine variety of specimens of woods have been added, besides some forty-seven species of pine cones, collected by the late Dr. Warder, many of them mounted in handsome wall cases. Very valuable additions also to the library have been made in this department, so much needed, and supplying the long felt want. We now have Bentham & Hooker's Genera Plantarum, Sach's Text-Book of Botany, Gray's Flora of North America, McAlpin's Botanical Atlas, and Chapman's Flora of the Southern States, and as our large Herbarium has quite outgrown the old and very defective case, we would most respectfully urge the necessity of having a new one constructed on the most approved plans and in every way suitable and worthy of our growing collection.

Very respectfully, DR. O. D. NORTON,
Curator.

Cincinnati Society of Natural History:

GENTLEMEN—My Ornithological report as Curator is as follows:

The collection of mounted birds has been enriched by the addition of twenty-three specimens, among which are

1 Golden Eagle. *Aquila chrysaëtus* (L) Cuv.

1 Muscovy Duck, *Carina moschata*, male.

1 Shoveler (Broad Bill) Duck, *Spatula clypeata* (L) Boie.

1 European (White) Swan, *Cygnus oler, adult.*

1 European (White) Swan, *Cygnus oler*, being young in downy plumage.

2 Black Swans.

These birds are well mounted, and with the exception of one of the swans, appear to be fine specimens.

Also two cases of mounted birds were received so badly damaged as to be worthless for our use.

To the collection of bird skins there have been added three specimens. The skins of the collection are well preserved and appear to be free from destroying insects and vermin in general.

The collection, is quite comprehensive as to our local fauna, but is lamentably lacking in specimens whose habitat is confined to regions other than our own. The Society possesses only a few of the species peculiar to the Western or Southern United States.

When at Washington, D. C., I ascertained that the Smithsonian Institute would exchange only for the particular specimens they desired. An examination of the printed list of *desiderata* of that Institute disclosed the fact that this Society had few or no specimens which the Smithsonian Institute wanted, and which we could spare.

Attention was then directed towards exchanges with Ornithological collections in various parts of the country.

After due consideration it was decided that the completeness of series of specimens of bird skins owned by this Society would be interfered with if exchanges were made from them. I would therefore recommend that additional specimens of our local fauna be obtained for the purpose of exchange with Western and Southern Ornithologists. These local specimens may be obtained by purchase, and also probably by donation. If all the collectors of this Society would be at the trouble to get such local specimens as fall within their reach, the Society would soon have on hand desirable specimens for exchange.

The receptacles for the bird skins are ample in point of mere size. There is a need, however, of economizing the space these receptacles provide.

The smaller birds greatly outnumber the larger ones, and are now crowd-

ed together. Should one specimen be affected with vermin it is likely to transmit these vermin to the remaining birds in the drawer. Furthermore, the plumage of the skins becomes more or less ruffled and disturbed, and the skins are not in position to be used in scientific study or examination. Some of the drawers of nine inches in depth have an overplus of small skins, which latter, if laid flat side by side, would not require a space vertically of more than two or three inches. The remedy for this is to provide simple adjustable wooden trays (which can be furnished at a nominal expense) and which can be fitted into these drawers, thus doubling, and sometimes trebling the drawer space, and enabling the specimens to be properly disposed and easily and quickly reached and examined.

The cases for the exhibition of mounted birds and mammals are also obviously inadequate.

In regard to the department of mammalogy, during the year twenty-one mounted mammals have been added to our collection, many of which are rare and fine. Among these may be mentioned the porcupine, Malayan *Sun* bear, *Ursus Malayanus:* Mexican free porcupine, female, *Springurus Mexicanus* Shaw Honduras: axis deer: *Cervus axis*, female, India: kangaroo: fine specimens of monkeys: jaguar: raccoon: fawn of hog deer (Cervus porcinus, *Zimm.*, Indian species, twenty-four hours old): prairie hare, etc.

Books added to the Library are Zoological atlas, Mivart's. vol. entitled "The Cat," etc.

With the earnest wish that the collection of birds and mammals may be increased, and become of still greater value to the student of Natural Science, this report is respectfully submitted.

Your obedient servant, WM. HUBBELL FISHER.

Cincinnati, O., April 1, 1884.

Report of Curator of Comparative Anatomy:

The cabinet embraces a variety of skeletons, mounted and unmounted. The entire skeleton of an emu, in ligaments, has been added this year. The skull of a six-banded armadillo is an addition, and several odd bones of some interest.

The custodian is in progress of cataloguing skeletal forms. He has put in order the case of avian shoulder girdles.

An appropriation of ten or fifteen dollars should be made to finish the articulation and mounting of the skeleton of the African ostrich. In short, the osteal museum on the fourth floor should have work and money displayed upon it.

During the year some rare and valuable mounted specimens have been added to the museum of the second floor. Among the additions may be mentioned a young jaguar, a large kangaroo, Malayan sun bear, a genet, a civet, bush cat, African porcupine, tree porcupine, armadillo, albino raccoon, axis deer, fawn of hog deer, prairie hare, group of monkeys, etc.

It would be well for the library to buy the "Standard Natural History," a book of six volumes, the cost of which would be twenty-five or thirty dollars.

The above is respectfully submitted. A. J. HOWE.

CINCINNATI, *April* 1, 1884.

Society of Natural History:

The collection has been named as far as possible, and is arranged in one of the cases so as to be seen to the best advantage.

Three new specimens have been added.

Very respectfully, A. E. HEIGHWAY, JR.,
Curator of Herpetology.

REPORT OF THE CUSTODIAN OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

To the President and Members of the Cincinnati Society of Natural History:

In accordance with the usual custom, your Custodian presents the following report of work done during the year ending April 1, 1884. As the curators of the various departments have presented their several reports, but little remains to be said, and it will be said briefly:

The time has been largely spent in cataloguing and arranging the specimens already in the cases, and placing the additions in their respective departments. A card catalogue of the Ichthyological collection has been completed, and in such a way that the descriptions of the different species can be readily consulted. A plan of an accession catalogue has been adopted, and it is the purpose to enter in this all the new specimens received, designating each with a number so that its history will not be lost. Uncatalogued specimens of the museum will also be entered in this book, so that eventually everything will be found here. This plan is subsidary to a card catalogue, however, as the last is the only true way of keeping an account of the specimens in the different departments of the museum.

The additions to the various departments have been referred to by their several curators. They have not been as numerous as might be wished, but in the Library the additions have been important. New names of

societies have been added to the exchange list, sets of proceedings of old societies have been completed, and there is now an excellent foundation for a valuable scientific library. It has been partially catalogued, and the books are thus made more readily accessible, especially the bound volumes of pamphlets.

The Museum has been visited during the year by over 2,200 persons. A small number, perhaps, but an increase over last year, and an indication of the growing importance of the Society. The schools have used the Museum largely, and have thus derived much benefit.

On the 23d of May last, the 176th anniversary of the birth of Linnæus, a reception was given by the Society to invited guests. About one hundred persons were present. Papers were read upon the life and upon the botanical and the zoölogical labors of the great naturalist, and at the conclusion of the exercises an informal exhibition of microscopic objects was given.

The feature of the year just past has been the institution of courses of free lectures. During the summer a series of ten lectures on Botany was delivered. These were given on Saturday mornings from June to August, and, notwithstanding they came in the middle of summer, when many who would have attended were away from the city, the course was quite successful. This induced the Executive Board to arrange for others, and during the fall and winter, from October to March, fourteen lectures on various branches of science were delivered to appreciative audiences. All these were free, and excited a considerable degree of attention among persons interested in scientific pursuits. There were treated subjects connected with zoölogy, botany, geology and archæology, and while they were well attended, it would appear that the range of subjects was too wide to have justice done to any one of them. In arranging for such lectures again it would be well to devote the six or eight to one branch of science, say to geology, or palæontology, or conchology, or entomology, and in this way to cover the ground in a more systematic and thorough manner. Through the medium of courses such as these, properly conducted, the society could be made one of the leading educational institutions of the city. The matter has been brought more forcibly to my mind since reading a notice of the address of Prof. Bickmore, of the American Museum of Natural History of New York City, before the Department of Superintendence of the National Educational Association at Washington last year. In his opening remarks Prof. Bickmore said:

"About two years and a half ago the authorities of the museum with which I am associated addressed a letter to the Board of Education of our city, suggesting that they select a limited number of their teachers to come

up to our institution, and that I should give them conversational talks (we scarcely call them lectures) upon the objects that we had on exhibition in our halls. It proved to be an extremely stormy day in winter when the first gathering took place, but all those invited were present, and we were at once impressed with the magnitude and importance of the work thus thrust upon us. The attendance of the teachers was so constant that the six informal talks were extended to eighteen or twenty. The Board of Education then addressed us a letter expressing their high estimation of the work thus begun and asking that fifty teachers be allowed to be present at the next course. At the conclusion of these lectures the Board wrote us another letter stating that there were one hundred and four schools in our city under their direction, and asking if accommodations could be made for at least one teacher from each of them, in order that there might be a distinct, definite influence going out from our Museum every week to each school, conveying important instruction and aiding the teachers to give the most complete information to their pupils upon human and comparative anatomy and zoölogy and other subjects upon which the board might require oral instruction to be given in the common schools. A course on zoölogy is now in progress, and every Saturday our little hall is filled to overflowing."

Is there not in some such course as this ample scope for work for this Society? It is here thrown out as a hint, but I hope in a short time to give a practical demonstration of Prof. Bickmore's plan, show how important it is, and how helpful it is in teaching.

Jos. F. James,
Custodian C. S. N. H.

April, 1884.

CONTRIBUTIONS TO THE FLORA OF CINCINNATI.

By Joseph F. James.

Read and referred to the Publishing Committee March 4, 1884.

The following remarks are the result of observations on the plants of the vicinity of Cincinnati, which have been accumulating during the past two or three years. The Catalogue of Plants of Cincinnati, published in 1879, was compiled hastily, and errors unfortunately crept in. Some of these were corrected, and some additions made in 1881, by Mr. D. L. James. The present observations embody the results of study of some of our species and genera, and are here presented in the hope of making our flora better known and of inducing others to study it. Some of the notes have appeared elsewhere, but others are entirely new.

I feel indebted to many persons for information in regard to localities. Most of all, to the late Mr. T. W. Spurlock, one of the most indefatigable students our flora has ever had; to the Misses Mohr, Dr. R. M. Byrnes, Mr. D. L. James, Mr. George B. Twitchell, Mr. C. B. Going, Mr. C. G. Lloyd and Mr. A P. Morgan, I am also indebted, and desire to thank for their assistance in making the list more complete than it otherwise would have been.

Joseph F. James,
Custodian Cincinnati Society of Natural History.

RANUNCULACEÆ.

7. Anemone Thalictroides, L., has been considered by many writers *Thalictrum Anemenoides*, Michx. It is still so named in Gray's Manual, and that authority was followed in the catalogue of 1879. Study of the species convinced me that it was more of an *Anemone* than a *Thálictrum*, and in Bull. Torr. Bot. Club, vol x., p. 56, I suggested that the old Linnean name be restored, and for the following reasons: It differs essentially from *Thalictrum* in having an involucre, and agrees in all respects with *Anemone*, except that Dr Gray makes the arbitrary distinction, "achenia—not ribbed." Omit the *not* and let it read, "Achenia pointed or tailed, flattened *or* ribbed," and the generic description of *Anemone* of Dr. Gray will fit admirably the Rue-Anemone. Since making my note to this effect, I find that Bentham and Hooker have placed *Syndesmon*, Hoffm., under *Anemone*, though Dr. Gray considered it a subgenus under *Thalictrum*.

11. Trautvetteria palmata, F. M., was inserted into the catalogue of 1879, on the authority of Mr. Lea's list published in 1849. No one has

since, as far as known, found it here, and it should be dropped from the list as not now occurring.

12. Ranunculus aquatilis, L.—Common White water-crowfoot. This was credited to Mr. Clark, but its late finding by Mr. Going places it again certainly on the list. It was found in great abundance near Glendale, O.

12 a. Ranunculus multifidus, Pursh.—Yellow water-crowfoot. This, an entirely new addition to the flora, has been lately found in a small swamp near Glendale, O., close to the other species.

17. Ranunculus repens, L., is a most variable species, closely allied to R. bulbosus and R. acris. Muller says (Fertl. of Flowers, p. 76) that bees visit the three species one after another indiscriminately. The species might be crossed in this way and the variability be thus accounted for.

BERBERIDACEÆ.

31. Caulophyllum thalictroides, Michx.—This is not a common species, only a few stations being known in this vicinity. It is to be sought for on wooded hillsides with a southern exposure, and is easily recognized by the large, glossy green leaves, and rather small yellowish green flowers. It is in bloom about May 1.

NYMPHAEACEÆ.

34. Nelumbium luteum, Willd.—The large Yellow Nelumbo, or Water Chinquepin, has been, in all likelihood, exterminated in this vicinity. Lea gives it in his list and Clark in his, though in the latter one, published in 1852, it was considered as extinct. In early days it doubtless grew in Mill Creek and in the Licking River, but the progress of civilization has driven it away. In the summer of 1877 I found it quite abundant in a pond back of Jeffersonville, Ind. It should be omitted from our list.

PAPAVERACEÆ.

37a. Chelidonium majus, L., Celandine.—Found in May, 1881, on Mount Auburn, probably escaped from some garden.

CRUCIFERÆ.

48a. Cardamine heterophylla, Wood.—An addition to our flora found in the spring of 1882 near Loveland, O., by the writer. Only a single specimen was to be had, but there is no question as to the identification. It differs from *C. laciniata* in having the leaves alternate, and from *C.*

diphylla in not having the continuous root-stock; the roots consisting of a series of oblong tubers like those of *laciniata.*

The genera *Dentaria* and *Cardamine* have, with good reason, been merged into one by Bentham and Hooker. The differences between them are the habit of growth and the root. In the former genus the leaves are often whorled, or at least are situated near the centre of the stem, and the roots are rhizomes. In the latter genus, the leaves are scattered on the stem, and the roots are mostly fibrous. The flowers and fruit are almost the same in both.

In a revision of the species of the section DENTARIA under CARDAMINE, I have suggested the following arrangement (Bot. Gaz. viii., p. 206):

48. CARDAMINE DIPHYLLA, Wood.—Stem leaves two, opposite; root-stock long and continuous.

48a. CARDAMINE HETEROPHYLLA, Wood.—Stem leaves two to seven, opposite or alternate; root-stock interrupted, of two or three toothed tubers. The forms with more than three leaves are *D. maxima*, Nuttall.

49. C. LACINIATA, Wood.— Stem leaves three, whorled; root-stock nearly as in the last.

Var. multifida, James (*D. multifida,* Muhl.), is a form of *laciniata* with finely dissected leaves. I have found the two forms on Lookout Mountain, Tenn., running into each other in imperceptible gradations.

52a. C. HIRSUTA, L. Var., sylvatica, Gray.– Both these forms have been found in our vicinity, but from some oversight they have not been previously recorded.

51. C. ROTUNDIFOLIA, Michx.—*C. purpurea*, Cham. & Schlecht., was inserted into the catalogue of 1879. It was intended to be the var., *purpurea*, of *C. rhomboidea*, D C. This variety is now considered *C. rotundifolia*, Michx., as above, though the description given of this species by Gray is not characteristic of our form. It seldom forms runners, and there are numbers of tubers mixed with the fibers of the root as in the *rhomboidea*.

59a. HESPERIS MATRONALIS, L.—Found by Mr. T. W. Spurlock, in Storrs Township. The stem is simple and erect; leaves lanceolate-ovate, denticulate Flowers purple; blooms from June to August.

65a. ALYSSUM LESCURII, Gray, given in a former list, should be omitted. There was a mistake in the identification.

66. CAMELINA SATIVA, Crantz.—This is given in Lea's catalogue. It has

not been recognized of late as far as is known. It is an introduced plant, with small yellow flowers and lanceolate and arrow-shaped leaves (Gray). It should probably be omitted from the list.

CARYOPHYLLACEÆ.

82. SILENE NIVEA, D C.—This species was first found in our locality by Miss Kate Peachey, along the Little Miami River, near Loveland, Ohio. The patch was a small one, but well established, though subject to overflow by the river, and liable to be buried out of sight under deposits of mud. The flowers are quite large, white, and at a hasty glance are liable to be mistaken for *S. stellata*, Ait., from which they differ, however, in having the petals cleft only, instead of fringed; and the leaves are opposite instead of whorled

86a. SILENE NOCTIFLORA, L.—Recorded by Mr. C. G. Lloyd as found at Crittenden, Ky. Escaped from cultivation.

PORTULACACEÆ.

98. CLAYTONIA VIRGINICA, L.—Mr. Davis L. James has made some interesting observations on the fertilization of this plant, which are here inserted from his notes.

"If the flower of *Claytonia Virginica* be observed soon after it opens for the first time, the stamens will be found standing erect and around the pistil, the lobes of the style closely pressed together, and none of the stigmatic surface exposed. The anthers are extrorse. The stamens remain erect the first day and the style lengthens slightly. The second day the stamens are mature, they begin to shed their pollen, and are bent towards the petals. The style has been further lengthened.

"On the third day in the life of the flower the filaments are bent outwards and the anthers are now closely pressed on the petals; the style has elongated, its lobes are recurved and the stigmatic surface is exposed. Flowers with reflexed stamens and a mature style, and with erect stamens and undeveloped style, are both found on one plant, the former always below the latter in the raceme. The insect observed in the work of fertilization is a small bee.

"Mr Meehan thinks that the pollen which is shed upon the petals by the ripening stamens is brought into contact with the stigma when the flower closes at night. But as the flower droops as it closes, the pollen would more likely fall to the ground. I have seen the pollen shed upon the petals in but one case. and that was in a plant brought into the house and placed in damp sand. Claytonia is quite fertile with us, not one out

of many hundred plants showing imperfect capsules. Heterostylism was not observed, all the specimens being alike."

The two species of *Claytonia* given by Gray, viz.: *C. Virginica* and *C. Caroliniana* are hard to distinguish. The only difference seems in the leaves. In the first they are linear, and the second "spatulate-oblong or oval-lanceolate" (Gray). As one seems to predominate in the West and South, and the other is a more northern form, it seems probable that the *Caroliniana* is more of a geographical variety than a distinct species. *C. Caroliniana* seems a misnomer, for it is the more northern form of the two.

MALVACEÆ.

107. NAPAEA DIOICA, Clayt., was inserted in the catalogue on the authority of Mr. Spurlock, who formerly found it in this vicinity. As it has not been seen for many years it would be wise to consider it extinct in our locality.

109a. GOSSYPIUM HERBACEUM, L. (Cotton Plant).—An introduced plant which has been found growing in the sweepings of freight cars in the yards of the O. & M. R. R., Storrs Township, on the Ohio River bank. The flower is quite large, yellow, turning with age to a reddish-brown; the calyx is subtended by an involucre of three bracts, and the fruit forms a solid boll. It is uncertain if it ripens here. The species can be considered as only doubtfully established.

109b. HIBISCUS TRIONUM, L.—Found at Loveland by Miss K. Peachey, is an escape from cultivation, and may be considered as naturalized.

110. HIBISCUS MILITARIS, Cav.—Was found during the summer of 1883 by Mr. George B. Twitchell, growing wild near Delhi, on the C. I. St. L. & C. R. R. This is the first time it has been recorded since Mr. Clark's list was published in 1852, and it thus re-establishes an old species.

GERANIACEÆ.

116. FLOERKEA PROSERPINACOIDES, Willd., is an inconspicuous plant, but has been found in great abundance near Ludlow Grove by Mr. Spurlock. It is a species liable to be overlooked, because of its manner and place of growth; the localities where it is found are damp or swampy.

VITACEÆ.

130. AMPELOPSIS QUINQUEFOLIA, Michx., is considered by our latest authorities to be VITIS QUINQUEFOLIA, Bentham & Hooker.

SAPINDACEÆ.

133. Aesculus flava, Aiton.—Sweet Buckeye. A peculiar feature of this species was noted in a tree growing near Loveland, O. The lowest branches started from the trunk at least twenty feet from the base, and then drooping suddenly came down to within about six feet of the ground, and then spread out horizontally. Nearly all the branches seemed to have the same mode of growth.

ANACARDIACEÆ.

141. Rhus venenata, D.C., is given in Clark's Catalogue. I have never found it here, nor do I know of its having been found lately. It should be omitted from the list.

LEGUMINOSÆ.

143. Trifolium pratense, L.—At the meeting of the Agricultural Congress at Montreal in August, 1882, Prof. W. J. Beal read a paper on the variations to be noticed in the red clover (*Trifolium pratense*). He spoke of the varied habit of growth, it being sometimes upright and sometimes spreading; called attention to the presence or absence of pubescence; to the presence or absence of spots on the leaves; to the variation in the number and color of the seeds, and said that he generally found the heads to be sessile. He further thought that by selection the varieties might be greatly improved. The variation which Prof. Beal did not notice so prominently has been noticed this year (1884) to be very common. In many instances I have found the heads of flowers to be distinctly stalked, sometimes these stalks being as much as two inches long.

In our botanies the distinctions between *Trifolium pratense* and *T. medium* are these: In the former the heads are sessile and the leaflets are spotted; in the latter the heads are stalked and the leaves are unspotted; while a still further difference is given by Hooker in Student's Flora of the British Isles; this is, that the pods of the *T. pratense* open by the top falling off, and those of the *medium* have a longitudinal dehiscence. None of these characters seem to hold good. In some specimens the leaves are spotted and the heads are stalked; in others the heads are sessile and the leaves are not spotted; while all the pods I have examined have a longitudinal dehiscence. Dr. Gray in the Manual says the one species is too near the other, and it would seem from the facts now known that it would be wise to unite the two species under the name of *T. pratense.*

149a. Medicago sativa, L. Alfalfa, Lucerne.—A plant with three parted leaves and blue flowers, extensively cultivated in many places as

food for cattle. It has been introduced in some localities here, has escaped and is well estalished. A large patch can be found near Newton Station on the L. M. R. R., and another on the I. C. & L. R. R. (Twitchell.)

153. ASTRAGALUS COOPERI, Gray.—This was found during the summer of 1883 by Dr. R. M. Byrnes, on the hills west of the city and near Price's Hill Incline. It was given in the catalogue on the authority of Mr. Lea, and its rediscovery is interesting. It differs from our common *A. Canadensis* in having the few flowers more loosely arranged in the spike, and in the pod being one instead of two celled.

176a. CASSIA OCCIDENTALIS, L—Though a native further south, this species has been found occasionally by Mr. Spurlock, growing in company with *Gossypium*, near Sedamsville. Only eight specimens were found, growing in such a situation that they were liable to be covered over or swept away at any time. They did not flower until very late, and only one or two perfected fruit. Another specimen was found by Mr. Going at the Stock Yards (C. W. & B. R. R.), but was killed by the frost before it bloomed.

177. CASSIA TORA, L. (*C. obtusifolia, L.*)—A few specimens were found by Mr. Spurlock on Bank Lick, back of Covington, also by Mr. Going at the Stock Yards with *C. occidentalis, L.*

178a. CASSIA NICTITANS, L.—Found growing on the Ohio River bank by Mr. Spurlock.

As all the five species given in Gray's Manual have been, at times, found in this vicinity, the chief character of each is here appended.

176. CASSIA MARYLANDICA, L.—Tall, with spike of large yellow flowers; six to nine pairs of leaflets.

176a. CASSIA OCCIDENTALIS, L.—Flowers smaller than the preceding; four to six pairs of acute leaflets; long, linear pods.

177. CASSIA TORA, L. (*C. obtusifolia, L.*)—Leaflets, two or three pairs, obtuse; pods six inches long.

178. CASSIA CHAMAECRISTA, L.—Stems spreading; flower, large, axillary; leaflets, ten to fifteen pairs, slightly sensitive.

178a. CASSIA NICTITANS, L.—Flowers very small; leaflets, ten to twenty pairs and sensitive, closing almost instantly.

The first and fourth of these are common in this vicinity, but the other three have as yet only an uncertain tenure, and can be considered only as waifs and strays.

ROSACEÆ.

193a. POTENTILLA RECTA, Willd.—This species has been found only within a few days growing in Eden Park by Miss Sarah C. Stubbs. It is a strong growing species, two or three feet high, with five to seven cut serrate leaflets, and large light yellow flowers. It is by far the handsomest Potentilla yet found here.

HAMAMELACEÆ.

219a. LIQUIDAMBAR STYRACIFLUA, L.—Sweet Gum. A quite hardy tree, planted by the late Dr John A. Warder, at North Bend, O. It has been observed in the woods near Mt. Healthy by Mr. Morgan. It grows abundantly throughout Kentucky.

HALORAGEÆ.

220. MYRIOPHYLLUM.—There are four species of this genus given in the catalogue on the authority of Mr. Clark. None have, as far as is known, been identified here of late years. They should be looked for in ponds and pools. An investigation of the canal basin near the Work-house, and of Ross Lake, would perhaps add to our knowledge of them. Other water plants, too, are likely to be discovered in these places.

ONAGRACEÆ.

232a. JUSSIÆA LEPTOCARPA, Nuttall.—This species is a strictly southern one, and was found on a floating log at the mouth of the Licking River by Mr. Lloyd. The following is the description, taken from Chapman's Flora of the Southern States, page 140:

"Hairy; stem erect, at length much branched; leaves lanceolate, acute; flowers small; calyx lobes mostly six, as long as the petals; capsule linear, cylindrical, much longer than the pedicel. Marshes, Florida and westward, June, September. Stem, two feet to five feet high; capsule, one and a half inches long, slightly curved."

It is to be hoped that this species will be found again. At present, however, it can not be claimed as belonging to our permanent flora.

UMBELLIFERÆ.

243. CAUCALIS ANTHRISCUS, Huds.—First discovered by Mr. C. G. Lloyd at Mt. Lookout, it has since been found by others, and is becoming thoroughly naturalized. It is supposed that it was first introduced with some imported cattle of Mr. Kilgour's. It cannot be considered a desirable addition to our flora. As the species is not noticed in any of our

botanical manuals the description is inserted below. (Hooker's Students Flora of British Islands, pp. 179–180.)

"CAUCALIS, L.—Annual, hispid herbs; leaves, 1–3 pinnate; umbels compound, terminal or leaf-opposed, usually of few rays sometimes bracts few or none; bracteoles more numerous; flowers, white or purplish, polygamous, outer often rayed; calyx teeth acute or none; petals often unequal, the larger notched, point inflexed; disk lobes, thick, conical; fruit, ovoid or oblong, constricted at the commissure; carpophore undivided or 2–fid; carpels sub-terete, ridges with one or two series of spines; vittae solitary in each secondary ridge; seed deeply grooved ventrally.

"C. ANTHRISCUS, Hudson.—Leaves, 1–2 pinnate; leaflets, broad; umbels, terminal, compound; bracts, 4–6; spines of fruit, incurved, not hooked. . . . . . . Hispid more or less; stem erect, branched, solid, striate; hairs reflexed; leaflets many, close set, one-fourth to one-third inches, pinnatifid or lobed; umbels, 5–12-rayed; bracts, small subulate; flowers, minnute, white or pink, outer pedi celed, fertile; fruit, one-eighth inch, ovoid; styles short, straight."

244. HERACLEUM LANATUM, Michx.—Credited to Mr. Lea's catalogue, but found this year at Cumminsville by Mr. Going. It has a very large umbel of greenish-white flowers, very large leaves and is very rank and coarse in growth.

253. CICUTA BULBIFERA, L.—Credited to Mr. Clark in the catalogue; was found near Ludlow Grove during 1883 by Mr. Spurlock. It grows abundantly in wet places. It is easily distinguished from *C. maculata*, by its linear leaflets, and the presence of numerous bulblets in the axils of the leaves.

ARALIACEÆ.

261. ARALIA SPINOSA, L., Hercules Club, etc.—This is not a common plant in this vicinity, but is a striking one in appearance. It grows fifteen or twenty feet high, with the slender trunk covered with prickles. The large compound leaves spread out in a cluster near the top of the stem.

COMPOSITÆ.

310a. ASTER LONGIFOLIOUS, Lam.—Very common in places along the Little Miami River at Loveland, O.

339. XANTHIUM SPINOSUM L.—Quite common along roads back of Covington, but never yet found on this side of the river.

347. LEPACHYS is now considered a synonym of RUDBECKIA.

362a. Coreopsis trichosperma, Michx.—Found by the Misses Mohr near Burnet Woods; afterwards by Mr. Spurlock on the canal near the Work-house. This is a very western station, as it is mostly confined to the coast. It is easily recognized by its finely dissected leaves and bright yellow flowers.

370a. Matricaria discoidea, DC.—This has been found near Loveland, O., in one spot, and was doubtless introduced with some plants from California. It has previously been recorded from only one or two localities in the eastern section of the country.

371. Leucanthemum vulgare, Lam., Ox-eye Daisy.—Is now referred back by Bentham & Hooker to the old name of Chrysanthemum Leucanthemum, L.

392. Lappa officinalis, Allione, is now called Arctium Major, L.

392a. Cichorium Intybus, L.—Cichory. Found by the Misses Mohr on Elm Street Hill, apparently well established. The flowers are quite large, bright blue, leaves minute and inconspicuous.

LOBELIACEÆ.

410. Lobelia spicata, Lam.—This has been credited to Clark's catalogue, but three or four spe·imens were found last year by the writer near Branch Hill, O.

CAMPANULACEÆ.

412. Specularia Americana, Morgan (*Campanula Americana, L*).—This common species is, I believe, a true *Specularia*. Wh le all the genuine Campanulas have bell-shaped, drooping, pediceled flowers, the species of Specularia have rotate, erect and sessile flowers. These last points are found in the *C. Americana*. In Hooker's Students' Flora of the Brit-Islands, *Specularia* is a sub-genus under *Campanula*. In the Genera Plantarum they are kept distinct. As Mr. A P. Morgan first suggested the change here given, he is credited with the new name.

412a. Campanula rapunculoides, L.—Found by the Misses Mohr on Elm Street Hill. Escaped and naturalized.

ERICACEÆ.

415. Monotropa uniflora, L. – A large bunch of plants of this species was exhibited before this Society on October 3, 1882. An examination of the cluster to see if any indication of parasitism could be found, revealed no connection between its mass of roots and those of the trees among which it grew. The mass resembled more the mycelium of a fun-

gus than true roots, and the conclusion reached was, that at that period of its life, at least, the plant drew its nourishment from the decaying vegetable matter among which it grew. Whether during a previous period the roots were connected with those of trees could not be ascertained, but all appearances were against such connection. (See Vick's Monthly Magazine, vol. v., p. 330–332.)

BIGNONIACEÆ.

430a. CATALPA SPECIOSA, Engelm.—First brought into notice by the late Dr. J. A. Warder, and by him considered a valuable tree for building and other purposes. The following is the description from *Botanical Gazette*, vol. v., p. 1:

"A middle-sized tree, with grayish brown, much cracked or furrowed, at last slightly flaky bark, and light yellowish gray wood; leaves large, truncated or more or less cordate at base, slightly acuminate, soft, downy on the under side, inodorous; flowers in large and loose panicles; tube of the corolla conical, longer than wide, its lower part scarcely protracted; upper lip before its expansion longer than the other lobes and enveloping them; lower lobe bi-lobed; inside of the corolla slightly marked at the throat with red-brown lines, and with two yellow bands at the commissures of the lowest with the lateral lobes; stamens and style as long as the tube, pod terete, strongly furrowed; wings of the seed about as long as the seed itself, rounded at the ends and split into a broad coma."

LABIATEÆ.

471a. TRICHOSTEMA DICHOTOMUM, L.—Found during 1883 on the Ohio River bank. A very much branched herb, with small flowers, and similar in habit of growth to *Isanthus caeruleus*, Michx.

CONVOLVULACEÆ.

533. CONVOLVULUS ARVENSIS, L.—Found by Mr. Spurlock and Mr. Going.

535a. JACQUEMONTIA TAMNIFOLIA, Griseb.—A few specimens of this species, native much further south, were found by Mr. C. B. Going at the Stock Yards on the C. W. & B. R. R. The description is appended. The plant can be considered as only a waif, and may or may not be found again.

"JACQUEMONTIA, Choisey.—A rather small genus, tropical or subtropical, mostly with the aspect of Convolvulus.

"J. TAMNIFOLIA, Griesb.—Erect or at length twining, fulvous-hirsute; root annual; leaves cordate and ovate, long petioled, pinnately veiny;

peduncles elongated, capitately many flowered; glomerate cluster involucrate with foliaceous bracts; sepals subulate linear, ferruginous-hirsute, 5 lines long, nearly equaling the violet corolla. Cult. and waste grounds, from South Carolina and Arkansas southward." (Gray Syn. Flo. N. Am., vol. ii, part 1, p. 214.) Chapman under *Ipomoea tamnifolia*, adds, "Capsule depressed, somewhat four-sided."

SOLANACEÆ.

540a. PHYSALIS PHILADELPHICA, Lam.—Quite common at Loveland, O. Identified during the past summer (1883).

546. DATURA METELOIDES, D C.—This seems to be the species formerly given in the catalogue as "*D. metel*, Locke." It is cultivated in old gardens and may have escaped to roadsides in some places. The principal characters of the species are as follows: Puberulent or pubescent; leaves ovate, entire or repand-toothed; corolla six to eight inches long, white or tinged with violet, sweet scented. Native along streams in Texas to Arizona and California. Chapman considers *metel* as a good species, but it is probably only a synonym.

546a. NICOTIANA TABACUM, L.—As this species is being largely cultivated in this vicinity it is likely to escape and be found along roadsides. It is easily known by the exceedingly large leaves and tall spike of tubular, pinkish flowers.

EUPHORBIACEÆ.

616a. EUPHORBIA CYPARISSIAS, L.—Growing abundantly on a private place near Loveland, O., and escaped from cultivation.

LEMNACEÆ.

678. LEMNA MINOR, L.—Given in the catalogue on the authority of Mr. Clark. It has recently (June 1884) been rediscovered at Cumminsville by Mr. Going.

NAIADACEÆ.

684. ZANNICHELLIA PALUSTRIS, L.—This species credited to Mr. Lea has been lately found by Mr. Going in the same locality as *Lemna minor*. There are, doubtless, many species of *Potamogeton* in our streams also.

TYPHACEÆ.

682a. SPARGANIUM SIMPLEX, Hudson.—Chester Park. Dr. R M. Byrnes.

ORCHIDACEÆ.

696. SPIRANTHES CERNUA, Richard.—A single specimen of this was

found September 17, 1882, by Mr. D. L. James near Loveland. It had not before been identified here since Clark's list was published.

IRIDACEÆ.

707. Iris versicolor, L.—This was found this year at Chester Park, by Mr. Going. Before credited to Mr. Clark, it is thus rediscovered. Dr. R. M. Byrnes has found it in Mount Lookout woods and at Batavia Junction, on the L. M. R. R.

CYPERACEÆ.

783. Carex crinita, Lam.—This was credited to Lea's catalogue, but has lately been found by Mr. Going near Glendale. The Carices of this vicinity have not been very industriously collected, and a little attention would doubtless add many species to the list.

GRAMINEÆ.

846a. Lolium perenne, L—This species, a new one to the flora, was found in Avondale by Mr. D. L. James.

851a. Avena striata, Michx.—A new species to the flora, and found by Dr. R. M. Byrnes.

854a. Phalaris Canariensis, L. (Canary Grass.)—Found frequently about houses and on rubbish heaps.

858a. Panicum virgatum, L.—Was found by Mr. Spurlock near Sedamsville. It grows from three to five feet high, and has a very long panicle of flowers.

859. Panicum latifoluim, L.—D. L. James.

861. Panicum dichotomum, Muhl.—D. L. James.

862. Panicum depauperatum, Muhl.—D. L. James.

865. Cenchrus tribuloides, L.—Hedgehog or bur-grass. "A vile weed" (Gray). Introduced and growing abundantly along the O. & M. R. R., near Riverside. Easily recognized by the spiny fruit.

EQUISETACEÆ.

874. Equisetum hyemale, L.—Miss Marie Mohr.

FILICES.

875. Polypodium incanum, L.—This species was found in a single locality a few years since by Drs. Byrnes and Langdon, and has lately been observed by the writer. Specimens were collected from a partially dead tree near Batavia Junction, on the L. M. R. R. It is very rare in this region.

OPHIOGLOSSACEÆ.

897. BOYTRYCHIUM TERNATUM, Swartz.—Mr. S. T. Carley furnishes the following information regarding this species: The frond makes its appearance in July, and the fertile part soon matures; the sterile portion persists till within a month of the time for the new frond to appear. In winter it is copper red, and in the spring changes to the original green of the young frond.

CHARACEÆ.

899a. CHARA CORONATA, Ziz.—This appeared in a tub of water-lilies near Loveland. The interesting genus, of which there are many species in the United States, has not been studied in our section. The canal basin near the Work-house, Ross Lake and similar places, will probably yield several species.

NORTH AMERICAN LEPORIDÆ.

BY CHARLES DURY.

(Read and referred March 4, 1884).

There are more species of true hares in the mammalian fauna of North America, than in any other country in the world. Our twenty-two species and varieties are pretty evenly distributed over the entire area of the country, from the Great Lakes to Florida, and from Maine to California. They are commonly called "rabbits." But the fact is, we have no rabbit indigenous. All are true hares. The rabbits of this country are introduced animals and are varieties of the European *Lepus Cuniculus*, which differs from the hares in its shorter hind legs and other features of the bony structure, as well as its different habits. In London, last summer, in visiting some animal dealers' shops, I was amazed at the differences in color and form of the domesticated rabbits offered for sale. There were white, black, grey, ash, yellow, buff, and all sorts of combination of these colors. In shape these were long, short, thick and thin. Some varieties had the hair short and in others it was long and silky, but the most astonishing freak of this artificial selection was the enormous lop-eared varieties. Some of these exceeded the largest known hare in size, and with a length of ear that would make our so-called "jackass rabbit" ashamed of its accomplishments in this direction. The ash or buff-colored giants have been brought from the little grey, short-eared *Lepus Cunicu'us* by artificial selection, within a short period. Artificial selection has accomplished more with the domesticated races of the genus *Lepus* than natural

selection has done with the wild ones. The true rabbit, in its wild state, lives in burrows in the ground, which it excavates, and into which it retreats for safety at the approach of danger. In these burrows the young are brought forth blind and helpless, while the hares bring forth the young on the surface of the ground and make the nest in a depression which they line with hair plucked from their own bodies. The rabbit is nocturnal in its habits, passing the day in its burrow, and issuing forth in the evening to feed. In England a collection of rabbit burrows is called a "warren," and in some of them there are thousands of individuals. They are hunted with "ferrets," a small animal allied to our weasel." The "ferret" is muzzled to prevent its capturing a rabbit in the burrow, for if it was not muzzled it would secure a victim, bite into its throat and gorge itself with blood and then go to sleep in the rabbit's nest, leaving the anxious hunter waiting at the mouth of the burrow for a chance to get a shot. There is nothing the English rabbit is so afraid of as a "ferret." When one enters a burrow there is a pell-mell rush to get away, and all the inhabitants of the group of invaded burrows scamper up and out of the nearest entrance, and off to other and more distant holes. Then the hunters blaze away right and left. Sometimes many rabbits are killed, but frequently in the excitement all get away. When the "ferret" has run them all out he comes walking leisurely out himself with a disgusted look on his grim visage. He is then taken by the gamekeeper, and, after the gentlemen are stationed at another suitable group of holes, the "ferret" is started in again and the fusilade is repeated. The poachers take advantage of the rabbit's dislike to "ferrets" and stop up all holes but two or three and start in the "ferret." Over the open holes they hold large bags, the rabbits rush into the bags until they are full; they will go into a bag or anywhere to escape the dreaded "ferret." The "ferrets" are trained for the purpose and rewarded for the part they take in this wholesale murder by a repast of blood when the battle is over. The fecundity of the rabbit is very great, the progeny of a pair in a few years amounting to thousands. Redfield says, "twelve litters of young are produced in a year by the English species, and were it not for their numerous enemies they would be a calamity.

The hare does not depend on a shelter of any kind for safety, but trusts to its fleetness of foot to escape from its enemies. Our familiar species *Lepus Sylvaticus*, the "sylvan hare" or "cotton tail" as the boys call it, will sometimes, when the weather is bad and snow is deep, go into a drain pipe or hole, but it can move away from a dog at a pretty good gait. But its best speed is not a circumstance to the way its long-eared cousin,

the "jackass rabbit," (*Lepus Callotis*) can climb over the ground when it tries. Ever since I read Mark Twain's account of this animal I wanted to make its acquaintance, and when in Southern New Mexico I was gratified. I did not see any until I reached the Mesilla Valley, but there they were abundant, but very difficult to shoot, as they ran away so quickly it was almost impossible to stop them. I only got a few by accident; the speciman exhibited ran past where I was hid in some mesquite bushes. I banged a charge of No. 8 shot broadside into him. When I went down to him, his sad, yellow-brown eyes bulged out a quarter inch, filled with reproach, (and sand) seemed to say: "How could you be guilty of so cowardly an act as that?" He was going as if he had forgotten something and when the shot hit him he could not stop long enough to die, but went fifty or sixty feet down the hill head over heels. Mark Twain says of the speed of this animal, "But one must shoot at the creature once if he wishes to see him throw his heart into his heels, and do the best he knows how. He is frightened clear through now, and he lays his long ears down on his back and straightens himself out like a yard stick every spring he makes, and scatters miles behind him with an easy indifference that is enchanting. Our party made this specimen hump himself, as the conductor said. The Secretary started him with a shot from the colt, I commenced spitting at him with my weapon and all in the same instant the old allen's whole broadside let go with a rattling crash, and it is not putting it too strong to say the rabbit was frantic; he dropped his ears, set up his tail and left for San Francisco at a speed that can only be described as a flash and a vanish; long after he was out of sight, we could hear him "whiz!" It was likely the "prairie hare" he alludes to, as it is the species in the country he was in. The true "jackass rabbit" can play all around this animal in running if he tries.

Two *Lepus Callotis* and several *Lepus Sylvaticus* confined together in an inclosure at the Zoological Garden, fought in a desperate manner, both of the *Lepus Callotis* were killed outright, the fur being almost stripped from their backs. The little hares attacked them with their fore-feet. *Lepus Sylvaticus* will fight with great fury among themselves, making the hair fly in every direction.

Our hare *Lepus Sylvaticus* is attacked by a large fly, called *Cutrebra Cuniculi*, which lays an egg in its back; this egg hatches into a larvæ that burrows under the skin and makes a sort of pocket in which it lives and sucks nourishment from the animal. I exhibit a specimen taken from the back of a hare; the animal was emaciated and weak. This larvæ is nearly full fed and is much shrunken from drying; so you can imagine

what a delightful counter-irritation it must have produced. The cry of this hare is seldom heard, yet it can scream like an infant in distress. I never but twice heard it—once when I reached into a pile of cordwood and caught hold of the hind legs of one that had squeezed in between the sticks. In pulling it out its skin was torn, and it yelled vigorously. I was so surprised at this, I let go my hold and the hare ran away like a streak. The hare can run with its hind legs tied together. Some German hunters, near Glendale, had caught one in a stone-pile, and when they stopped for lunch, one of their number tied its hind legs together with his red silk handkerchief. No sooner had he laid the animal on the ground than away it dashed, taking the pocket-handkerchief with it, and though the owner of the bandanna yelled, "Skoot him, Skoot him," his friends, who had laid down their guns were too paralyzed with astonishment to shoot, and the visions of "hasenpfeffer" vanished with the handkerchief. I may add the disinterested spectators in the vicinity smiled audibly.

The "prairie hare" (*Lepus Campestris*) from Kansas and Colorado is called "jackass rabbit" in Kansas, and "snowshoe rabbit" in Colorado; it is a very different animal however from *Lepus Callotis*, and turns nearly pure white in winter. The specimen exhibited of this hare, is in the autumnal pelage. One of the smallest of the North American hares is the "little sage hare," (*Lepus Nuttalii*) found in the West, from Nevada down to Texas. The speciman exhibited is from New Mexico, and killed near where the *Lepus Callotis* was taken. Mr. J. A. Allen has decided this to be but a diminutive race of our sylvan hare and calles it *Lepus Sylvaticus var Nuttalii*. They feed on the leaves of the sage and grease-wood, and if the intestines are allowed to remain in the abdominal cavity after death, even as long as thirty minutes, the flavor goes all through the flesh and renders it so bitter as to be uneatable, but if they be immediately drawn they are good eating. I found the jackass fellows tough, stringy and tasteless, but waxed fat on the little ones, which I broiled in front of the fire with festoons of pork wrapped around them. The only animal that can catch the "jackass hare" is the greyhound and they can only do it under favorable circumstances. I measured, by the tracks in the sand, some of the down-hill leaps made by one of these hares and found them to be over twelve feet.

The hare crouches all day in its "form," which is a place in a tuft of grass or weeds, hollowed out just the size of its body. In this position it is always ready to spring out and away. When started from its "form" it never goes back to the same one, but makes another; but if undisturbed it uses the same one more than once. The white hare exhibited, is (*Lepus*

Americana) in the winter pelage; it is of a rich brown and grey coat in summer. This species occurs in New York, Michigan, Pennsylvania, Canada, Minnesota, and perhaps in the northeastern part of Ohio. It is a fair table species.

The largest hare we have is the "polar hare," (*Lepus timidus var borealis*), which occurs in Dakota, Washington Territory and the Hudson Bay Company's possessions. It is the largest species in the world and identical with the hare of Ireland, England and Scotland. It is white in winter and brown in summer, and completely mimics its surroundings.

A very interesting species is the "water hare," (*Lepus Aquaticus*), a species with an enormous head. It takes to the water to elude its enemies and swims with great speed and ease; it also goes into the water and swims about. feeding on the tender shoots of aquatic plants of which it is very fond. Its flesh is worthless as food. It occurs in South Illinois, Kentucky, Tennessee, Georgia, Alabama, etc.

The marsh or swamp hare, (*Lepus Palustris*) has about the same range, but lives in the dense thickets and canebrakes on the edges of the water; both of these species are great desiderata in many collections.

Lepus Bairdii or "Baird's hare," found in the Rocky Mountain region, is perhaps more remarkable than any, from the fact that the male has the mammalary glands fully developed, and assists the female in suckling the young. A case without a parallel I believe in nature. Mr. John M. Murphy gives an interesting account of this in his work on the "Game in the Far West," published by a house in London, and authenticates it by statement of the surgeon who dissected the animals.

Lagomys is a genus of rodents allied to the hares, which includes four species: one in the northern mountains of Europe, one in Mongolian Tartary, one in southeastern Russia and one in the Rocky Mountains of the United States. Ours is called the "little chief hare" (*Lagomys princeps*). They lay up a store of food for winter use and their cry is like the bleat of a sheep.

Six species of extinct hares have been described from the Miocene deposits of Dakota and Colorado. They are about the same size as existing species and belong to the Genera

Palæolagus, *Panolax*, and *Praotherium*.

Let us return thanks that the zoological "hair splitters" have not been able to subdivide the genus *Lepus* up into eleven genera, each one to take in a species and its varieties. They can do it with the fossil species, as perhaps the genus is founded on a broken tooth or the head of a broken rib, and one or two collections contain all the pieces ever collected.

In concluding, I tabulate the hares somewhat according to size as follows, beginning with the largest:

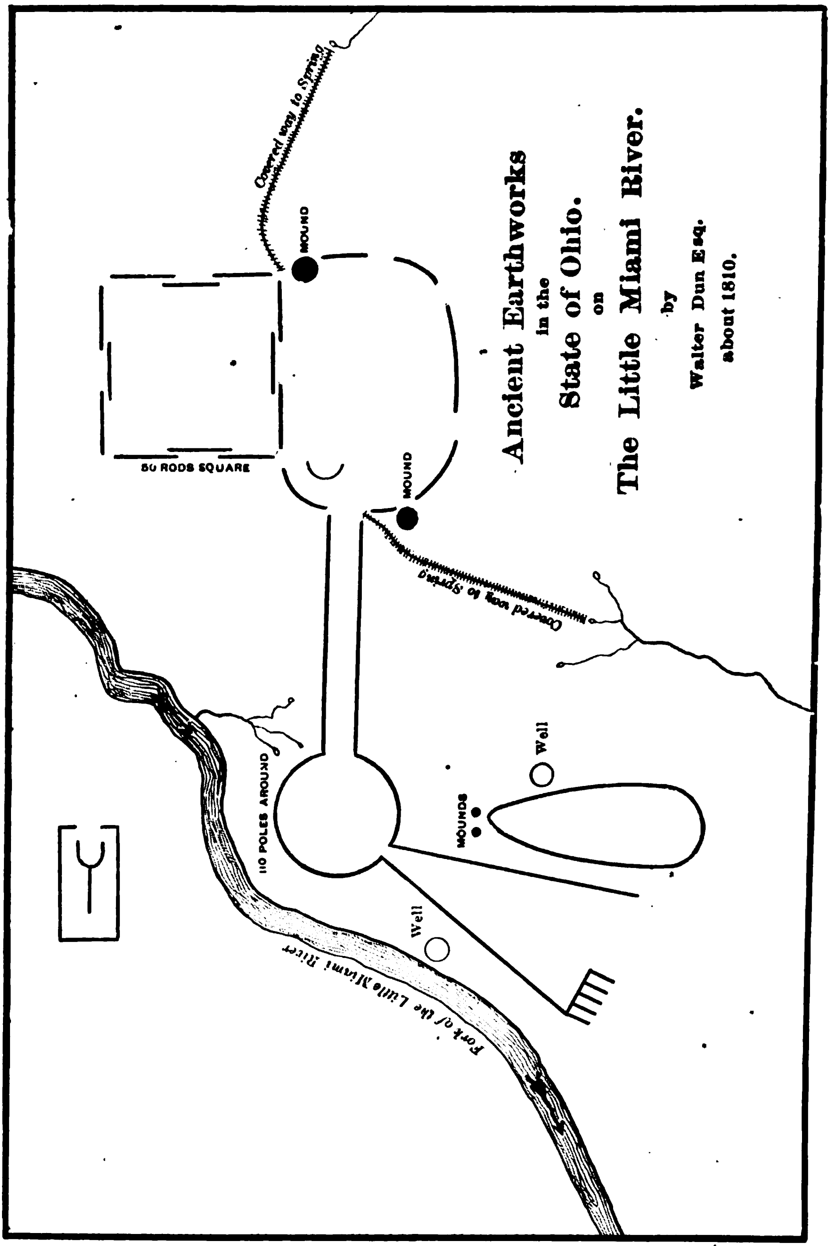
1. *Lepus timidus.*
   " " *var Arcticus.*
2. *Lepus Callotis.*
   " " *var Callotis.*
   " " " *Texanus.*
3. *Lepus Campestris.*
4. *Lepus Californicus.*
5. *Lepus Aquaticus.*
6. *Lepus Americanus*
   " " *var Americanus.*
   " " " *Virginiensis.*
   " " " *Washingtonii.*
   " " " *Bairdii.*
7. *Lepus Palustris.*
8. *Lepus Sylvaticus.*
   var Nuttalli.
   " *Auduboni.*
   " *Arizonæ.*
9. *Lepus Brasiliensis.*
10. *Lepus Graysonii.*
11. *Lepus Trowbridgi.*

ANCIENT EARTH-WORKS IN THE STATE OF OHIO, ON THE LITTLE MIAMI RIVER.

BY WALTER A. DUN, M. D.

Dec. 4, 1883.

It is my pleasant task to-night to communicate to this Society some of the earliest plans of those interesting earth-work remains situated on the Little Miami River. The plans which I now have the pleasure to lay before you were found by me while delving among some old family papers. They are the rude drawings of a surveyor, taken on the field, and I regret to say that so far I have been unable to recover the notes which evidently go with them. They are the work of my grandfather, Walter Dun, Esq., who died at Lexington, Ky., in 1838. The date of these plans is uncertain. From 1806 to 1838 my grandfather was an active surveyor in the Virginia Military Land District. Yet the fact that these plans are not


Ancient Earthworks
in the
State of Ohio.
on
The Little Miami River.
by
Walter Dun Esq.
about 1810.
Covered way to Spring
MOUND
MOUND
Covered way to Spring
50 RODS SQUARE
110 POLES AROUND
MOUNDS
Well
Well
Fork of the Little Miami River

more distinctly designated by roads, counties or other landmarks inclines me to the belief that they were among his early labors, and probably date back at least to 1810.

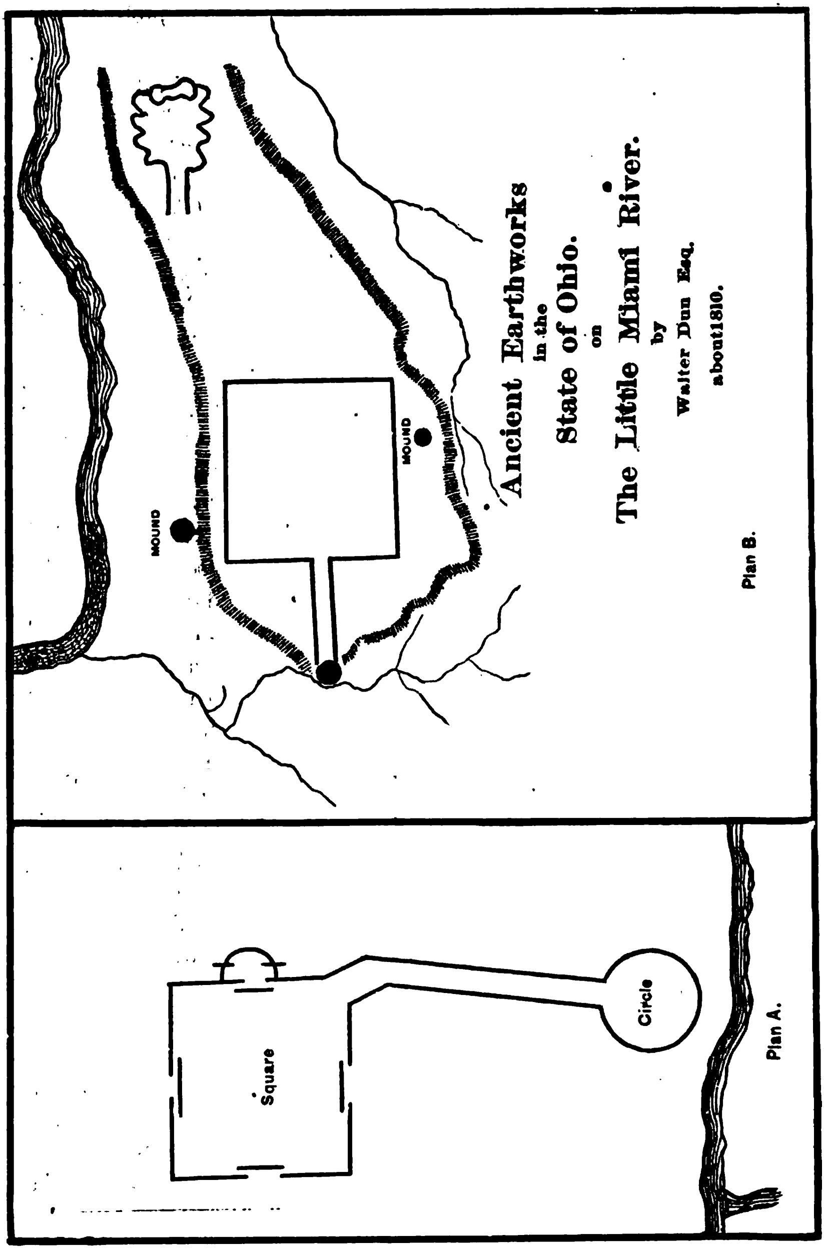
Walter Dun, my grandfather, was educated at the University of Glasgow, and struck, no doubt, by the peculiar conformation of these structures, made these plans and took other notes on the ground, which afterward were made into other and better plans in his office, and no doubt formed the material for a communication to his old University at Glasgow.

Two of the plans, with a third supplementary plan, are perhaps now presented for the first time to a scientific society in this country. Their exact location is not known, except that they are on the Little Miami River, and are probably not far removed from the other plans, which are of works near Milford, in Clermont Co., Ohio. The other plans are identified as the same as Nos. 1 and 2 of Plat 34, Vol. 1, Smithsonian Contributions to Knowledge, by Squier and Davis, 1847. The first plate is interesting in a double sense. Although the rough drawings of a surveyor on the field it corresponds pretty accurately in the measurements given by Davis in 1847. It is far more interesting from the fact that it notes and locates much more of the surrounding works and details of the work itself than is to be found in the survey of Davis. This may be accounted for in two ways. Either these had disappeared from view under the plow in the time which intervened between the surveys, or they escaped the observation of Davis. I can vouch for the utmost correctness of these rude plans, and base it entirely upon the character of the man and the fact that he was a most accomplished and accurate surveyor. Gen. Lytle, of Cincinnati, made a survey of this same work, which was published in Warden's Appendix to Du Paix's Antiquities of Mexico.*

The second plan, which appears in (Vol. I, Ibid) is taken from Warden's Adpendix above mentioned, where it appears from a survey of Gen. Lytle; Squier and Davis never saw it, and do not vouch for the details of the plan which so nearly resembles the plan which I now exhibit and which is certainly older than that of Gen. Lytle.

These plans are not only interesting from a historical point of view, but also from the interest which these ancient monuments excited in the educated pioneers of Ohio, which in this case prompted these plans, and which in one of these, at least, adds additional interest and value in the greater details shown, which have probably been eradicated by the plow. Then, too, they belong to the region near the cemetery and its adjoining mounds

* Vol I, S. Cont. Knowledge. Page 95.


Ancient Earthworks
in the
State of Ohio.
on
The Little Miami River.
by
Walter Dun Esq.
about 1810.
Plan B.
MOUND
MOUND
Square
Circle
Plan A.

so recently the subjects of investigation by an extinct society with a long name and a learned Eastern professor. I can not close these few sheets without making an earnest appeal to this Society to *at least* raise its voice and demand of the new Legislature an appropriation for the accurate and complete survey and investigation of these mounds and earthworks. I would like to raise voice against the destruction of these remains, but well know the uselessness of it; and, since they can not be preserved in tact, a good survey is the next best thing, and an investigation and collection of their relics in some museum, where they are not indiscriminately scattered, would greatly aid students of this department and redound to the credit of the State and its people.

SWISS LAKE DWELLERS.

By Walter A. Dun, M. D.

While traveling in Switzerland in the summer of 1882 I secured these relics of the ancient Swiss Lake Dwellers, and am glad I have this opportunity to submit them for your inspection.

They came from the dredging operations in making the quay at the city of Zürich, situated at the lower end of that long narrow Züricher See and at the point where it is drained by the river Limmat. This body of lake water, some twenty-five miles long and two or three broad, situated at the beginning of the northern spurs of the Alps and extending at its southern point between its rugged mountains, is peculiarly interesting as the lake in which the first remains of the Lake Dwellers were discovered in 1854.

I understand that before my return from Europe our worthy Custodian presented to this Society a paper on this subject, so that I will confine myself to a few interesting observations which I made on the scenes of the dwellings of these people. A rapid glance at the various lakes in Teutonic Switzerland, where these remains are most abundant, will show in the main that their general trend is north and south and that the southern portions are surrounded by rugged Alpine crags, while the northern banks extend into low plains gradually ending in bogs of peat, or at any rate lowlands and valleys from which outlets lead to the sea. When viewed from some commanding eminence, as the Uetliberg or Rigi Kuhn, the shallow points or tracts of water are very perceptible by a beautiful light bluish color. The lakes of Lucerne, of Zug and of Zürich show all the points I have alluded to, and being in the trodden path of tourists and travelers, can not escape observation. It is along the portions of those lakes, where a low level country surrounds and where the water is shallow, that the

Lake Dwellers were most numerous. It may have been their nature to build in the water, yet it seems far more probable to me that the peculiar remains of cities or towns built over the water on piles were due to the fact that the people merely adapted themselves to the circumstances of their surroundings. At the present time scattered along the banks of these lakes, and especially to be seen on the lake of Zug, are many houses of the present Teutonic Swiss peasants, which project over and incroach upon the lake waters. The area of arable land being small, it is used for agricultural purposes, and a dwelling built over the waters of the lake is so much space gained. Then, too, the means of communication being by water, the house subserves the triple purpose of dwelling, storehouse for exports, and boat house. Any one with slight experience in boating must know how nasty it is to land a boat in shallow water with a low boggy bank. It would be among the first natural impulses to avoid a repetition of such semi-wading, miry experiences, and this was no doubt easily accomplished by a pier of logs, which, being constructed and improved upon and extended as time passed, gave the initial start to the architecture of pile construction. The farther this pier was extended into the lake the deeper the water, so larger boats with heavier draft could approach and unload. This must have considerably increased the labor of carrying these articles ashore, and eventually have led to the building of a storehouse at the end of the pier, and thus the first house was built over water, and around it would naturally cluster, as time passed, other houses for occupants, which would eventuate in a lake dwelling settlement. Then, of course, as soon as each house could be approached by all classes of boats, the necessity of a general supply from a storehouse would disappear and the storehouse be converted into other purposes. Other advantages were undoubtedly derived from this mode of living. The excrement of men and animals was disposed of in the lake, thereby avoiding much danger, for we know that the two great diluents and oxidizing agents for noxious matter are air and water. The offal from eating also no doubt attracted and fed quantities of fish, of which we are certain, judging from the remains of nets and hooks, these ancient people fully availed themselves.

The purpose of defense I believe to be entirely one of secondary consideration Dr. Daniel Wilson splendidly defined man when he said, "He is the fire using animal." We find no prehistoric remains so extensive or numerous in Switzerland as those of the lake dwellers. Are we then to believe that their pile towns have defended them from barbarians less civilized and less numerous than themselves? In defending themselves from tribes of similar lake dwellers they would have been worse in these dwel-

lings than on land, for being of wood built on water they would have been more easy of approach by boats and set on fire, for example, at night, leaving the way for retreat open. There is no agency so powerful in war for havoc, devastation and panic as fire, and to tribes of lake dwellers these villages would have been an easy prey. It is true that we have evidences of the burning and rebuilding of these towns, yet it has been attributed to accident rather than the horrors of war. It is further true that had they been compelled to fight a barbaric land enemy of great strength we would have looked for them to fortify some of the commanding eminences about the lake, since they were an industrious people. Based, then, entirely upon these few facts, I think that if they ever acted a part in defense it was chance and a secondary part to their original conception and purpose. There are a few other interesting facts about these people. They were Asiatic in origin, as numerous bones of their domestic animals, viz.: the cow, horse, sheep, hog, etc., which are of Asiatic origin, attest. They were a people who, while engaged in fishing, hunting and war, yet were in quite a degree agricultural, and, more than that, cultivated their grain with skill. They had apples, ground nuts, wheat, etc., showing considerable degree of cultivation. They are peculiar as representing in some settlements stone relics alone, while in later settlements implements of copper and bronze occur. We often hear of the ages of stone, copper, bronze, iron and steel, but these are indefinite phrases; we have no ages, they are merged gradually one into the other. We call ourselves the age of steel, and still you find stone, copper, bronze and iron used; and just so all ages after the *stone* age are combinations to which time has added the others. The lake dwellers, then, in their earlier periods, used only implements of stone, later they began the use of copper and bronze, which in a measure superceded the stone and materially enhanced their progress.

This advance of a rude people may well be likened to the foundation of a house in which each course of stone is necessary and also prepares the way for the one to follow. Each course must have its beginning, gradually cover over the previous one, to be covered itself in its turn. Just so is it with this subject of ages. Each, like a course of stone or brick in a foundation, must have its beginning. It is laid in the mortar of a previous age, which it does not suddenly blot out, but gradually covers and supersedes, leaving a small space uncovered. Thus, at the beginning of the age of bronze, that article was rare; gradually it became more plentiful and superseded stone in the exact proportion as it became more plentiful, and so on it has been with those ages that follow. Perhaps the most interesting point connected with this curious people lies in a consideration of their

relative age and their relation to history. There is no doubt that the remains of those older settlements, where stone implements alone were used, are of very great age, and of them we have no record and no history, except what is deduced from their silent remains. In some of the latter settlements, however, there appears undoubted relics of Roman origin, which links them to the dawn of history and reveals them to us as the celtic tribes of Helvetia described in Cæsar's Gallic Wars. Numerous references are to be found among ancient Greek and Roman authors describing the lake-dwelling nature of this people, and it is probable that part of their progress in the art of metallurgy was derived from intercourse with the more advanced Greeks, Romans, Phœnicians or Carthagenians, who traversed and settled the regions bordering upon the Mediterranean Sea.

The peculiar nature of building houses upon piles is not only manifested in the instance referred to in some of the Swiss peasants of to-day, but it also has an example in the city of Venice, founded and built upon piles by the Venetian tribes of fishermen. This city, once the grandest in the world, is fast falling to decay. The piles which support that grand structure, St. Mark's Cathedral, are gradually giving way and the floors of those beautiful mosaics are sinking. Yes, Venice is strangely built upon piles imbedded in the mud of low islands and shallow seas, and is an ideal representation of what the residence of the lake dwellers might have been expected to develop into in modern times under the influence of art, affluence and power combined with the advances of civilization.

I will detain you only for a summary of these points. These people were of Asiatic origin, a part of the first great wave of Aryan people, viz.: the Celtic. They had advanced beyond the hunter period before leaving Asia, and had become a nomadic pastoral people with their herds of domesticated animals; reaching Switzerland, into which they were crowded by later waves, they found some difficulty in this nomadic, pastoral life from the rugged nature of the country. The lakes abounded in fish, while their level shores were fertile. Under these influences they could but adapt themselves to circumstances, and so they began to be an agricultural people, retaining their hunting and fishing proclivities and also their stock. Circumstances, which I have before described, eventually led to their dwelling in lakes. We have also in these people the link which connects the people who used stone relics with the history of the Romans, and which are thus connected with modern times, as well as examples of the introduction of copper and bronze. Recent discoveries in the lakes and bogs of Scotland and Ireland would seem to indicate that the celtic inhabitants of those countries had similar proclivities. Yet, with this important difference,

in Switzerland they built on piles, while in Ireland and Scotland they built on low islands; on the other hand, in Venice they built on both piles and islands. The tracings of the philologist of this celtic people by means of their language and their stories from Asia, as a wave of the great Aryan race, have received additional confirmation by the discovery of bones of the domesticated animals from Asia among their remains. This brief sketch, only intended to embrace a few points, I hope will be accepted by you as such.

NOTES ON COLEOPTERA, WITH ADDITIONS TO THE LIST OF THE COLEOPTERA OF CINCINNATI.

BY CHARLES DURY.

(Read and referred July 1, 1884.)

Adranes Le Contei.

While searching for rare beetles near Avondale recently, I turned over a small beech log, partly decayed, that was honey-combed by a medium-sized pale brown species of ant. On being disturbed, the ants rushed about in great confusion; among them I recognized several *Adranes Le Contei*, a small beetle belonging to the family *Pslaphidæ*. *Adranes* is one of the most remarkable beetles known, both in habits and structure; it has a minimum number of joints in the antennæ—there being but two, the usual number in the Coleoptera being about eleven, while in some of the Longicorns there are twenty-seven. The eyes are entirely wanting, as in some of the beetles found in caves; the abdominal segments are connate. The species is quite rare in collections, and has never been recorded before from this locality.

On each side of the body and just back of the elytra is a tuft of brown hair, and from it springs a tube from which the beetle exudes a fluid that the ants are supposed to eat, and this will explain why the ants permit these beetles to live in their nests. What *Adranes* eats is a mystery; but it is certain that the ants get more than they give in the association. I was convinced that the ants were friendly to the *Adranes*, as I placed other insects in the nest, which the ants immediately attacked with great fury and soon tore them to pieces.

"LADY-BIRDS."

The terminal shoots of a cherry-tree were covered thicklv with *Aphidæ*, or plant lice; the leaves shriveled and turned brown; I thought the tree

would be ruined. On June 20 I observed many "Lady-birds" on the tree. The "Lady-bird," so-called, is a small beetle belonging to the family *Coccinellidæ.* Two species, especially, were very numerous: *Adalia bi-punctata* and *Brachyacantha ursina.* To-day, July 1, not one of these plant lice was to be found on the tree, but numerous cast-off skins of larvæ and pupa were everywhere hanging to the leaves, and told the story how silently and efficiently these friendly little beetles had done their work and saved the tree from complete destruction.

ADDITIONAL SPECIES OF COLEOPTERA.

Since the publication of the "List of Coleoptera observed in the vicinity of Cincinnati," in this JOURNAL, October, 1879, and additions, December, 1882, the following twelve species have been observed:

Heluomorpha præusta (Dej.), one specimen.
Eleusis pallidus (Lec.), several specimens.
Adranes Le Contei (Brend.), six specimens.
Chevrolatia amœna (Lec.), one specimen.
Corymbites Copei Horn, one specimen.
Obrium rubrum (Newm.), one specimen.
Chelimorpha cassidea (Fab.), one specimen.
Bolitophagus depressus (Rand), two specimens.
Rhipidandrus paradoxus (Beauv.) one specimen.
Wollastonia quercicola (Boh.), several specimens.
Orchestes niger, several specimens.
Choragus species (?), two specimens.

ERRATUM—APRIL NUMBER.

Page 23, lines 11, 12, 13, and in description of figures, for *Cerampora* read *Ceramopora.*

L. Soc. 120

Vol. VII. No. 3.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee.

JAMES W. ABERT, A. P. MORGAN,
GEO. W. HARPER, WALTER A. DUN.

OCTOBER, 1884.

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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. VII. CINCINNATI, OCTOBER, 1884. No. 3.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *July* 1, 1884.

President Hunt presiding. Sixteen members present.

S. F. Trounstine and Reuben H. Warder were proposed for active membership.

The Minutes of the preceding (April) business meeting were read and approved.

The Minutes of the Executive Board for April, May and June were then read.

Dr. Walter A. Dun read a paper on "Recent Floods in the Ohio River." The paper described the physical conditions necessary to a destructive flood, and stated that forests had but little influence in changing these conditions. The height of the water in the river at Cincinnati during remarkable floods from the earliest records to the present year was given.

Dr. Langdon asked if the measurements were all reduced to one standard, viz.: the Water Works' mark.

Dr. Dun replied that the figures for years subsequent to 1832 were taken from the records of the Water Works Office.

The paper was referred for publication.

Mr. Chas. Dury read some notes on new Coleoptera collected in the vicinity of Cincinnati.

Mr. Dury's paper was also referred to the Publishing Committee.

Prof. J. F. James made some remarks upon certain markings on the rocks of the lower silurian which have been referred to seaweeds. Some of these he was confident were made by the movement of crinoid stems over the soft mud. The occurrence of the trails of annelids and markings

resembling rain-drops, seemed to indicate shallow water, if not shore lines.

Dr. Dun said he had observed, near the tops of the hills, something that resembled ripple marks.

The Secretary exhibited some galls of Cynips saltatorius, "the jumping gall," collected by Mr. E. P. Robbins near Greenfield, Highland County, Ohio. Mr. Robbins had observed vast numbers of them, and stated that the sound made by their movements resembled the patter of rain upon the leaves.

Mr. William Hubbell Fisher made some statements regarding the scientific value of "Gentry's Birds of North America," a book now being offered for sale in the city. The book was not considered of the highest value from a scientific standpoint.

Donations were received as follows: from Dr. Zipperlin, specimen crab; from Alfred Stokes, three specimens silk worm cocoons; from Smithsonian Institute, Proceedings U. S. National Museum, 1883,—Sigs. 32, 33; from Chas. Dury, Eighth Annual Report of Ohio Fish Commissioners; from Signal Service Officer, Weather Review, April, 1884; from D. L. James, three specimens plants; from C. B. Going, five species plants; from C. F. Low, specimens of concrete and ashes from mounds near Newtown; from S. A. Forbes, Normal, Illinois, Thirteenth Annual Report of State Entomologist; from University of Tokio, Japan, Okadairo Shell Mound of Hitachi; from Wm. McMaster, mounted specimens of Road Runner, California; from Miss Nettie Fillmore, eleven species California plants; from F. W. Putnam, two pamphlets on Anthropology; from G. W. Landers, specimens of scorpions from Mexico; from A. J. Woodward, M. D., specimen Pholas costata from Florida.

Adjourned.

August 5, 1884.

Dr. D. S. Young, President *pro tem.*, presiding. Ten members present.

Minutes of meeting for June read and approved.

A communication from Mr. U. P. James was presented and read, entitled "On Conodonts and Annelid Jaws," with descriptions of four new species from the Cincinnati Group.

The paper was upon motion referred to the Publishing Committee.

Mr. Chas. Dury read a paper "On the Oswego and Black Bass," in which he held that, though separated by most authors, the species were varieties arising from a difference in habitat and an abundance or deficiency of food. Ross Lake had been stocked with bass a few years ago, all of the small-mouthed species, and at this time none of that species have been

found, though the Oswego Bass is abundant. Swift running water seemed to be the home of the Black Bass, while the Oswego Bass was only found in ponds or slow running streams.

Dr. Dun said he had caught Oswego Bass in the Kanawha River under the Falls, in swift water, but thought that Mr. Dury's position was, in the main, correct.

Dr. Young said that the colors of fish vary with the season. In still streams all fish became larger and "more flabby." He had noticed that fish taken from the lake in winter were more deeply colored and of better shape than those taken in the autumn. In the Mohawk River in New York, bass vary from white to black and mostly with small mouths, a character supposed to belong exclusively to the Black Bass. He had caught the large-mouthed form in the same stream, but thought it had been bred in ponds in the vicinity which flow into the river. The mouths of all fish change with age. Mr. Dury's paper was referred for publication.

Dr. Dun exhibited some photographs of strata and specimens from Eden Park showing ripple marks.

Mr. J. F. James said he had observed similar markings in the strata on the river bank near Ludlow, Ky.

Messrs. R. H Warder and S. F. Trounstine were unanimously elected members.

On motion of Dr. A. E. Heighway, Sr., the Secretary was directed to convey to the Hon. John Follett the thanks of the Society for his kindness in procuring for the Museum from the Smithsonian Institution a specimen, preserved in alcohol, of *Pentacrinus decorus*, dredged from the Gulf Stream.

A collection of 108 species of North American Coleoptera, collected and mounted by Mrs. Chas. Dury, was presented to the Society.

Donations were received as follows: from the Bureau of Education, three pamphlets; from Chas. Dury, one pamphlet; from Smithsonian Institution, Proceedings U. S. Nat. Museum—Vol. VII., Nos. 1 to 9; from A. Stoehr, two pigeon eggs; from Hon. John F. Follett, one specimen, Pentacrinus decorus, in alcohol; from Chief Signal Service Weather Review for May, 1884; from Miss Nettie Fillmore, one specimen Lilium Canadense; from Miss Adeline A. Stubbs, one specimen Lilium Grayii, Roan Mt., N. C.; from R. H. Warder, one specimen Frangula Caroliniana; from Dr. R. M. Byrnes, two specimens Astragalus Cooperi, one specimen Chenopodium botrys and two specimens Erysimum cheiranthoides; from J. F. James, specimens of fossils, shells and insects from Kentucky and Mammoth Cave, one pamphlet, Contributions to Flora of Cincinnati; from

Wm. Wiswell, through Dr. A. E. Heighway, Sr., specimen of wood and bark of Sequoia gigantea, California; from E. A. Keeshan, specimen of Horned Toad; from A. E. Heighway, Jr., one volume, Gordon's Pinetum; from Mrs. Chas. Dury, 108 species N. A. Coleoptera.

Adjourned.

TUESDAY EVENING, *September* 2, 1884.

Vice-President Harper presiding. Eleven members present.

Minutes of August meeting read and approved.

Col. James W. Abert read a paper on the "Village Indians of New Mexico," illustrating his remarks with blackboard sketches.

Referred to Publishing Committee.

Prof. J. F. James presented a paper on "The Fucoids of the Cincinnati Group." The author held that many of the markings on the rocks hitherto referred to organic origin are probably due to such natural phenomena as rainfall on muddy flats, or to waves running over soft mud.

Prof. Harper said that the thoughts brought forward by Mr. James were quite similar to those passing through his mind during a sojourn at the seashore this summer.

The paper was referred.

A letter from Mr. Chas. Dury, asking that a committee be appointed to procure from the Exposition Commissioners, if possible, a collection of minerals from Colorado, now on exhibition.

The Society thanked Mr. Dury for his letter, and referred it to the Executive Board for attention.

The Society then adjourned.

Donations were received as follows: From C. B. Going, seeds of *Sparganium eurycarpum;* from Signal Service Bureau, Monthly Weather Review for June, 1884; from Dr. D. T. D. Dyche, specimen of Fossil Sponge and *Depranodus arcuatus,* from near Lebanon, Ohio; from Prof. F. W. Putnam, one pamphlet; from U. S. National Museum—Plates VIII. to XIV. inclusive, to Vol. VI., Proceedings U. S. National Museum; from John Schimmel, Ohio Statistics for 1881; from Chas. E. Beecher, pamphlet on Ceratiocaridæ; from Smithsonian Institution, Annual Report for 1882; from U. S. Fish Commission, Nos. 9 to 16 of Bulletin of the U. S. Fish Commission; from Lieut. Thos. L. Casey, two copies of "Contributions to Descriptive and Systematic Coleopterology of North America," Part I.; from Zoölogical Garden, Cincinnati, specimens of *Cercocebus collaris, Cynocephalus Mormon, Lemur brunneus, Cebus fatuellus, Semnopithecus entellus, Dasyprocta punctata, Erinaceus Europæus* and *Didelphys quica;*

from J. F. James, Cones of *Larix Europæus* and specimen of *Anomalodonta alata;* from S. T. Carley, specimens of *Unio alatus* and *Margaritana complanata;* from Jas. R. Challen, specimens of Free Gold in Quartz; from Dr. O. D. Norton, Kidney Iron Ore; from D. W. Lewis, Flint Spear Point and Snake; from Wm. R. Moore, specimen of clay from Green Township, Hamilton County, O.; from Dr. Zipperlen, photograph of *Proteus;* from Jas. R. Newman, Secretary of State of Ohio, Ohio Agricultural Reports for 1880, 1881, 1882.

SPONGES.

By Edward M. Cooper.

Perhaps no other branch of the Animal Kingdom led early naturalists into so many errors, and has been the cause of so much mistaken conjecture, as the sponge. Known as it has been from times of the highest antiquity, it was to the ancients something between a plant and an animal. Rondelet denied at first the existence of sensibility in sponges, and originated the idea that these productions belonged to the Vegetable Kingdom. An idea which even Linnæus in the first editions of his "Systema Naturea" supported by the great authority of his name. Afterward, influenced by the convincing labors of Trembly and some other observers, Linnæus, withdrew the sponges from the Vegetable Kingdom and maintained their animal nature, his views being adopted by the great naturalists of Europe; and the more information we gain on the subject, the more convincing is the proof that such a view is correct. For subsequent observations have proved that the living sponge has the power of opening and closing at pleasure its oscula (or large openings) which are capable of acting independently of each other, thus fully establishing the animal nature of these simple organizations, in which latterly even traces of sensibility have been detected, such as one would hardly expect to meet with in a sponge. For these creatures, as we are entitled to call them, are able to protrude from their oscula, the gelatinous membrane which clothes their channels, and on touching these protruded parts with a needle, they were seen by Mr. Gosse to shrink immediately; a proof that the sponge, however low it may rank in the Animal World, is yet far from being so totally inert or lifeless as was formerly imagined.

Sponges inhabit every sea and shore, and extend to all depths of the

ocean, but perhaps attain their maximum development between 500 and 1,000 fathoms. They differ very much in habit of growth, for whilst some can only be obtained by dredging at considerable depths, others live near the surface, and others again attach themselves to the surface of rocks and shells between the tide marks.

The branched sponges, with a compact, feltred tissue, are more common than others in the colder, martime domains, where the species of a loose texture, which grow in large massive forms, either do not exist or are very rare. Many sponges are of considerable size, such as the vase-like tropical species, known under the name of Neptune's Cup. Others are almost microscopical. and while by far the greater number grow superficially from a solid base, some penetrate like destructive parasites into the texture of other animals.

Zoölogists generally class the sponge with the protozoa, but Haeckel's investigations led him to decide that the sponge is not a protozoan, but belongs to a type only less highly organized than the lower polyps, and with more analogy to the radiates than the protozoa. He regards them as closely allied to the hydroid polyps, and his reasons are based on the fact that the sponges are made up of two layers of cells (Ectoderm and Endoderm, or outer and inner layers) surrounding a central cavity, and that both reproduce by eggs and spermatozoa. Gegenbaur and some English naturalists have indorsed this view.

Lieberkühn made the discovery—confirmed by Haeckel—that sponges are really Hermaphrodite Animals, reproducing by eggs and sperm cells developed in the same individual sponge. Haeckel showed that they were probably developed from the inner (Endodermal) layer of cells forming the body. These cells transform into an egg in the following manner: at first, provided with a collar and flagellum, it begins to draw these in until they disappear, then a nucleus appears within the nucleolus of the cell. The egg soon becomes detached from the body-wall, and moves about, sometimes penetrating into the exoderm or emigrating from the stomach to be fecundated abroad. After fecundation of the egg it begins to undergo self-division, splitting into two, four, eight, sixteen, etc., nucleolinated cells; the process being exactly as in the eggs of nearly all the higher animals, including man. This stage of segmentation Haeckel terms the Morula Stage. The cells of the Morula afterward separate into two kinds, a few remaining round, the majority becoming long and prismatic, and provided each with a cilium, by means of which it swims about and looks like a "planula" or larval Jelly Fish. This stage Haeckel consequently calls the Planula Stage; the next step is the forma-

tion of a stomach or internal cavity in the body of the ciliated larva. After swimming about for a time it becomes fixed by the end of the body to some object, the cavity finally opening out by a mouth. Afterward the true sponge character of the organism is revealed. The body wall becomes perforated with pores, which open into the general cavity of the body, while currents of water are maintained by means of the cilia, and flow out through the so-called mouth. This is the proto-spongia state, and when spicules of silex or lime are developed to strengthen the walls of the body, the young sponge is termed the "Olynthus."

Hartwig says of the Porifera, or sponges, that they were formerly supposed to belong to the Vegetable Kingdom, but their animal nature is now fully ascertained. For modern research has proved that the soft glairy substance with which their skeleton is invested during life, consists of "sarcode" similar to that which forms the soft parts of the Foraminifera and Polycystina. It is by this animated or organic gelatine, which can generally be pressed out with the finger, and in some species is copious to nauseousness, that the solid parts of the sponge are deposited, and from it the whole growth of the mass proceeds.

The framework or skeleton of the Porifera is usually composed of horny fibers of unequal thickness, which ramify and interlace in every possible direction, anastomosing with each other, so as to form innumerable continous cells and intricate canals, the walls of which in the recent sponge are crusted over with the gelatinous living cortex. Generally this fibrous mass is interwoven with numerous mineral spicules of a wonderful elegance and variety of forms, for their shapes are not only strictly determinate for each species of sponge, but each part of the sponge, it is believed, has spiculæ of a character peculiar to itself. Sometimes they are pointed at both ends, sometimes at one only, or one or both ends may be furnished with a head like that of a pin, or may carry three or more diverging points, which sometimes curve back so as to form hooks; sometimes they are tri-radiate, sometimes stellar; in some cases smooth; in others beset with smaller spinous projections like the lance of the Saw Fish. In many species they are imbedded in the horny framework; in others, as for instance, in Tethia Cranium, or in Halichondria, they project from its surface like a tiny forest of spears. They are generally composed of silex or flint, but in the Genus Grantia they consist of carbonate of lime.

Though the skeleton of most sponges is formed both of horny fibers and of mineral spicules, yet the proportions of these two component parts vary considerably in different species. In the common sponge, for instance, the

fibrous skeleton is almost entirely destitute of spicules, a circumstance to which it owes the flexibility aud softness that render it so useful to man; while they predominate in the Halichondria, and sometimes even as in the Grantia completely supersede the horny fabric

On examining a sponge, the holes with which the substance is everywhere pierced may be seen to be of two kinds: one of larger size than the rest, few in number and opening into wide channels and tunnels which pierce the sponge through its center; the other minute, extremely numerous, covering the wide surface and communicating with the innumerable branching passages which make up the body of the skeleton. Through the smaller openings or pores, the circumambient water freely enters the body of the sponge, passes through the smaller canals, and ultimately reaching the larger set of vessels, is evolved through he larger aperturest or Oscula. Thus by a still mysterious agency (for the presence of Cilia has as yet been detected in but one genus of full-grown marine sponges), a constant circulation is kept up, providing the sponge with nourishing particles and oxygen and enabling its system of channels to perform the functions both of an alimentary tube and a respiratory apparatus.

Dr. Grant describes in glowing terms his first discovery of this highly interesting phenomenon. "Having put a small branch of sponge with some sea water, into a watch glass in order to examine it with the microscope and bringing one of the apertures on the side of the sponge fully into view, I beheld for the first time the spectacle of this living fountain, vomiting forth from a circular cavity, an impetuous torrent of liquid matter, and hurling along in rapid succession opaque masses, which it strewed everywhere around. The beauty and novelty of such a scene in the Animal Kingdom long arrested my attention, but after twenty-five minutes of constant observation, I was obliged to withdraw my eye from fatigue, without having seen the torrent for one instant change its direction or diminish in the slightest degree the rapidity of its course. I continued to watch the same orifice at short intervals for five hours, sometimes observing it for a quarter of an hour at a time; but still the stream rolled on with a constant and equal velocity."

The innumerable canals by which the sponge is traversed—according to Milne-Edwards—are at once its digestive organs and breathing pores. The vibratile cilia are necessary to the renewed æration of the water required as a respiratory fluid in the interior canals of the sponge. The currents in these channels have one constant direction. The water penetrates the sponge by the numerous orifices of minute dimensions and irregular disposition; it traverses channels in the body of the mass and finally makes its

escape by special openings. Thus the channels perform the two functions of digestion and respiration. The rapid currents of aerated water which traverse them lead into them the substances necessary to the nourishment of these strange creatures, and at the same time carry off all excremental matter. At the same time the walls of these canals present a large absorbing surface, which separates the oxygen with which the water is charged and disengages the carbonic acid which results from respiration.

At the present time sponge fishing takes place principally in the Grecian Archipelago and the Syrian Littoral. The Greeks and Syrians sell the product of their fishing to the Western nations. Fishing usually commences towards the beginning of June on the coast of Syria and finishes at the end of October. But the months of July and August are peculiarly favorable to the sponge harvest. Lalakia furnishes about ten boats to the fishery. Batroun twenty, Tripoli twenty-five to thirty, Kalki fifty, Simi about one hundred and eighty and Kalminos more than two hundred. The boat's crew consists of four or five men, who scatter along the coast for two or three miles in search of sponges under the cliffs and ledges of rock.

Sponges of inferior quality are gathered in shallow waters; the finer kinds are found only at a depth of from twenty to thirty fathoms. The first are fished for with a three-toothed harpoon, by the aid of which they are torn from their native rocks, but not without deteriorating them more or less. The finer kinds of sponges are collected by divers; aided by a knife, they are carefully detached. Thus the price of a sponge brought up by diving is much more than that of one harpooned. Among divers, those of Kalminos and of Psara are particularly renowned. They will descend to the depth of twenty-five fathoms, remain down a shorter time than the Syrian divers and yet bring up more sponges. The fishing of the Archipelago furnishes few fine sponges to commerce, but a great quantity of very common ones; the Syrian fisheries furnish many of the finer kinds, while those from the Barbary Coast are of great dimensions and of a very fine tissue.

As fossils, the sponges are among our oldest inhabitants, occurring, as they do, largely in the silurian and then on through nearly all the formations, until in the cretacious we find the chalk almost wholly composed of the remains of sponges and rhizopods. Shells perforated by the Boring Sponge (Cliona) appear in the silurian rocks, while species of the same genus inhabiting our seas to-day show that their race has survived from the earliest Palacozic times until now. The great bulk of the Jurasic, "Sponge-Limestone," consists of the remains of calcareous sponges. This

immense deposit is thickest in Suabia to Franconia, but thins out gradually as it extends through Switzerland and Bourgogne; in Suabia there are rocky walls and cliffs many hundreds of feet high where no stone can be turned without exhibiting traces of sponge structure.

No very satisfactory classification of the sponges has as yet been made. although many recent writers have attempted, with more or less success, to arrange the very numerous forms now known into definite groups.

With a few exceptions, all sponges contain spicules. These are either silicious or calcareous. We may, therefore, divide the sponges into two sections, the first being called Calcarea. Skeleton chiefly composed of calcareous spicules, which are generally three-rayed. All the species are marine, and none appear to attain large dimensions, while some of the very smallest sponges known belong to this section—Grautia Compressa, one of the commonest British sponges, will serve as an example.

The second section is called the Silicia. Skeleton mostly horny, most frequently strengthened with silicious spicules; these are sometimes absent, and, in at least one genus, the sarcode becomes not even differentiated into a horny skeleton. The sponges belonging to this section are found both in fresh and salt water. Prof. Schmidt proposes to divide it into three divisions:

1. Where the spicules assume a sex-radiate type. To this will belong some of the most remarkable and beautiful sponges, as the Euplectella.

2. Where the spicules are anchor-shaped, or of a pyramidal form, containing many very familiar genera; especially the genus Spongilla, met with in fresh water.

3. Where the spicules are monaxial, polyaxial, or wanting; here, amongst a host of genera and species, would be placed the genus Spongia, to one or more species of which the various sponges known as sponges of commerce must be referred.

Probably the most beautiful and curious of all sponges are those known as the Glass Sponges. As early as 1835, the distinguished naturalist, Von Siebold, brought from Japan some curious wisps of glass hair measuring about twelve inches in length. Similar specimens were subsequently sold as seaweed by the Japanese curiosity mongers to European tourists and seamen. One end of these wisps was usually inclosed in a leathery sheathing and stuck into a piece of coral. Japanese ingenuity lends itself so freely to the concoction of impossible monsters, that anything strange, in the way of a natural curiosity, from that country is regarded with distrust. Combinations so skillfully made as to defy detection, except at the hands of the comparative anatomist, have made naturalists wary.

The first Hyalonema Sieboldii was therefore placed by the great microscopist, Ehrenberg, among the specimens of Japanese art. New specimens, less mutilated than the first one, were constantly added to the European museums, until finally Hyalonema was promoted from the cabinet of Japanese art to the museum of natural curiosities.

Still the question as to its origin and nature remained doubtful; the artificial combinations in which it was generally found, were very misleading. The investing leathery membrane was undoubtedly a polyp. The cup-shaped body which inclosed the wisp was no less certainly a sponge; but the wisp itself remained a mystery. This curious and anomalous form was to be classified, and the war of sponges began. All this time while the angry war of words went on, Hyalonema stood on its head waiting to be classified. Not one of all its angry champions knew enough to put it in its correct position. The conical mass had been from the first assumed as its base, out of which the spreading wisp of glass hair was supposed to spring upward into the water. Finally Prof. Lovin, of Christiana, pointed out the fact that the Hyalonema had been described in an inverted position. He first suggested that the glass coil was used for the purpose of anchoring the sponge in the mud, and, of course, formed its base. In 1868, Dr. Percival Wright brought up a specimen of Hyalonema from a depth of 600 fathoms in Setubal Bay, off the coast of Portugal.

The Holtenia, which was also dredged off the coast of Portugal, is in shape a symmetrical oval, or sphere, with a cup-shaped depression in the top. The two, however, which bear off the palm for exquisite beauty are the Rossella Velata and the Euplectella Speciosa. The Rosella is not unlike the Holtenia; its body is of a symmetrical oval form, composed of a beautiful network of glass spicules invested by the sarcode. The Euplectella is even more beautiful than any of the others; it is brought from the Philippine Seas. The first specimen was described and figured as early as 1841 by Richard Owen, and was called E. Aspergillum. In 1858 the E. Cucumer, and later, the most exquisite of all -the E. Speciosa—made their entrée into scientific society, the acknowledged queens of the Glass Sponges.

The Euplectella belongs to a very special group of sponges which have been called the Hexactinellidæ, from the circumstance that the silicious spicules throughout the whole family appear to be six-rayed. This fundamental form is often curiously masked—one, two, three or four of the rays being frequently suppressed; but where this is the case, some branching or splitting of the central canal, or some symmetrical arrangement of projections in the ornament of the spicule, is sure not only to refer it to its

ground form, but to give some clue to the particular kind of suppression or modification which has taken place.

The group belongs specially to the Deep Sea Fauna, and seems to thrive best among the elements of nascent limestones. The Euplectella, as we see it in collections, is simply the skeleton of the sponge, the soft, gelatinous coating having been removed. The skeleton is composed of silicia and resembles a delicate fabric woven in spun glass. It is in the form of a slightly curved tube, contracted downward and expanding upward to a wide circular mouth, edged by an elegant frill. The mouth is closed by a wide-meshed, netted lid. The walls of the tube are formed by a number of parallel longitudinal bands of glassy silicious fibers, closely united together by a cement of silica, and a series of like bands running around the tube and thus cutting the longitudinal bands at right angles, and forming a square-meshed net. The corners of the squares are then filled in with a minute irregular fretwork of silicious tubing, and the openings in the wall of the sponge become rounded. Ornamental ridges of the same fine fretwork are arranged in irregular spirals on the outer surface, and round the bottom of the tube a fringe of glistening threads of silica rises four or five inches long. The Glass Sponges have no commercial value, probably, except as curiosities, and were no doubt intended to represent the æsthetic side of Nature.

AUTHORITIES QUOTED: Figuier, Hartwig, Gosse, Haeckel, Milne-Edwards, Wyville Thomson, etc.

A BRIEF SKETCH OF THE FLOODS IN THE OHIO RIVER.

BY WALTER A. DUN, M. D., M. R. C. S.

Read before the Society, July 1, 1884.

The excessively high water, which we have all recently witnessed in the Ohio River, renders even a brief and necessarily incomplete consideration of the causes which produce it, very interesting. The daily papers, in answer to popular wish, have been filled with accounts of the vastness of the great overflow and sad tales of suffering, havoc and devastation. The editorial pages have not been silent. In almost every issue for a couple of weeks, in February last, they attempted a full and complete explanation, enumerated the causes and suggested a remedy, at least so far as this city is concerned.

In the multitudinous array of causes thus enumerated or among the numerous theories advanced, it would, indeed, be strange if the true ones

were not included. The difficulty arises in sifting, in separating the wheat from the chaff, and in allotting to each its proper value, without exaggerating its influence.

A record of the floods in the Ohio River will be found below in the order of their occurrences: In 1858 the gauge at the Cincinnati Water Works was established, and all records since that time are taken by that standard. The figures given before that time are from well-authenticated marks reduced to the Water Works standard. The gauge at the Water Works corresponds as nearly as possible with the depth of water on the Four Mile Bar above Cincinnati, and was as nearly exact as it was possible to make it when the standard was established.

The greater apparent frequency of high water in recent years may be due, in part, to the more accurate records. Yet allowing a great deal for this, there still seems to be a greater frequency in recent years than can be wholly accounted for in that way.

Reference to the list of floods at once shows that since 1858, when the records were begun, the river has reached more than forty feet each year. It is only in those floods of fifty feet or more that danger and damage occur, so that those are the ones which interest us particularly.

FLOODS IN THE OHIO RIVER OF FIFTY FEET OR MORE.

1774.—It is traditional that in March of this year there was a great flood in the Ohio.

American Pioneer, Vol. I., p. 345, says of Joseph and Samuel Martin: "The following winter the two brothers hunted on the Big Kanawha. Some time in March, 1774, they reached the mouth of the river on their return. They were detained here by a remarkably high freshet in the Ohio River, which, from certain fixed marks on Wheeling Creek, is supposed to have been equal to that of February, 1832."

1778–9.—John Cleves Symmes, in a letter to Col. Dayton, dated North Bend, May, 1789, says, that the whole country thereabout had been inundated, and that "the season was remarkable for the amazing height of the water in the Ohio, being many feet higher than had been known since the white people had come into Kentucky."

MEMORANDA BY JUDGE GOFORTH READS THUS:

"September 25, 1789, Major Stiles, old Mr. Bealer and myself took the depth of the Ohio River, and found that there was 57 feet of water in the channel, and that the water was 55 feet lower at that time than it was at that uncommonly high freshet last winter. The water at the high flood

was 112 feet." Not to cast doubt upon these early observers, we may allow considerable for the inaccuracy of their instruments and suppose that they struck a deep hole in the river in September. All accounts agree that there was an uncommonly high river, and it was probably of longer duration than ever since.

1792.—During this year there was a great flood covering the land now known as Columbia. The water must have been more than sixty feet.

1815.—Another great flood occurred this year, of less magnitude than 1792.

1832.—The weather conditions of February, 1832, were very similar to those that prevailed in February, 1883. A record of the former year at Cincinnati is not attainable; but Nathaniel Gates, who resided at Gallipolis, Ohio, a point on the Ohio River not so far distant from Cincinnati as to vary the conditions materially, made a daily record during the year, from which the following excerpta refer to the month of February:

"1st.—Warm and pleasant.

2d.—Warmer.

3d.—Warmer; 62°; snow going fast.

4th.—Warmer; 68°; snow all gone; soft mud plenty; river rising.

6th.—Rainy and muddy; river over the banks.

7th.—Cloudy and warm.

8th and 9th.—Rain all the time; 60°.

11th.—River rising; garden under water; pleasant weather; 67°.

12th.—Water rising fast; up to maxim.

14th.—Highest water known since the flood by three feet, and rising yet.

15th.—Water rising; houses, barns, hay and grain stacks in abundance.

16th.—Water at its maximum—four feet and two inches higher than ever seen by white men.

17th.—Water begins to fall slowly; the only towns on the Ohio banks not inundated are Gallipolis, Burlington and a part of Maysville, and the hill part of Cincinnati; all the fences and other movable property swept from all the farms on the river bottom from Pittsburg to Louisville, and how far below not yet known; cloudy, rainy, dull, disagreeable weather.

18th.—Water falling fast; warm; 60°.

19th.—Rain all day; plenty of mud.

20th.—Water out of the garden; snows continually, mingled with rain: Oh, what a disagreeable winter!—nothing agreeable or cheerful.

21st.—Rained.

22d.—Warmer; the sun appears twice.

23d.—Warm morning; cloudy; 10 o'clock, snows and is cold.

24th.—Cold, cloudy, wet and disagreeable.

25th.—Ditto, and mud enough to content anybody.

26th.—Continues cold and damp.

27th.—Cloudy; wet; some snow.

28th.—Rained all day moderately.

29th.—Clears off in the afternoon; chilly, damp atmosphere; snow not yet gone; roads and streets almost impassable.

This month is remarkable for many extraordinary circumstances, warnings, etc. The Ohio has done more damage by overflowing banks than has ever been done since the first settlement of the country. The destruction of houses, wheat, hay, corn, fences, etc., banks falling, bridges destroyed, all business suspended, general distress for wood, coal, etc., and no possibility of obtaining a supply."

Almost the same conditions brought about almost the same results in 1883 and 1884. The first great flood of which correct record now exists was that of February, 1832. There are several points in the city where permanent high water marks were made on the 18th day of the month, and they agree almost exactly. The stage of water on that date was 64 feet 3 inches. The population of the city then was 28,014, less than one-twelfth as numerous as now, and the city proper was bounded by the Miami Canal on the north, the Ohio River on the south, Deer Creek on the east and Western Row (Central Avenue) on the west. No such means as the telegraph, or even the railroad, existed by which the news of an approaching flood could precede it, and warn the inhabitants of coming danger. Unheralded, the water began to come on the 8th, and increased in volume ten days, at the end of which time it covered between thirty and forty squares of the city, which was nearly all then crowded into "the bottoms." Therefore, nearly the whole city was inundated, the effects being much more disastrous to Cincinnati of 1832 than to Cincinnati of 1883 or in 1884. Many houses floated away. Two lives were lost by the giving way of foundation walls, the men being buried in the wreck.

1847.—When Cincinnati contained about 96,000 inhabitants, the river began to swell December 10, 1847, and reached 63 feet 7 inches on the 17th. The rise was from streams on *both sides* of the river, that empty their water into the Ohio at points above here. There was a heavy fall of snow on the 15th.

1883.—February 15th, 66 feet 4 inches.

1884.—February 14th, 71 feet ¾ inches.

The record of rainfall since 1835, almost half a century, is given below. While only at one point, throughout the great Ohio Valley, the general uniformity of average is so marked that some weight may be given to it as indicating to a greater or less degree the general rainfall throughout the basin, it must be kept in mind that local rains often increase the monthly record, which is not a general increase throughout the whole area drained by the Ohio River. On the other hand a general rainfall shows an increase at this as at other points. Thus in July, 1875, 9.47 inches of rain fell, mostly during the latter part of the month, and the record here is of a general rainfall. Such an unprecedented and general outpouring gave rise to the only anomaly in the list of floods, viz., that of August 6, 1875—55 feet 5 inches.

The floods are directly dependent upon the amount of moisture precipitated throughout the valley, which is a statement apparently contradictory to the record of rainfall. The explanation lies in the fact that the record often shows great rainfall due only to local rains at this place; while during our winters moisture comes down as snow and hail, and accumulates, and when this melts during a general rainfall later, the streams have a double supply to carry off at once. The records and tables given have been taken from the Report of the Relief Committee of the Chamber of Commerce, of Cincinnati, 1883, U. S. Signal Service and Mr. R. B. Moore, Journal Cincinnati Society Natural History, Vol. I., page 57, and other sources already acknowledged.

This brief sketch, then, is defined at the outset as an attempt to give to each element, which lies at the cause of the floods in the Ohio, its proper value.

Upon consulting anyone, learned or ignorant upon this subject, all will be found filled with theories or explanations entirely satisfying and convincing to themselves, and the number and variety of these reasons is equaled only by the number you consult.

It is a settled maxim of physicians, that in any disease where a host of agents are recommended as remedies, none are reliable, and that the treatment of that disease is unsatisfactory. It is also equally true that, in any case where, after careful consideration, a number of good lawyers express directly opposite opinions, the law in the case is vague and indefinite.

The very fact, then, of the great variety of opinions as to the cause of floods, necessarily certifies to the rather obscure nature and understanding of them.

TABLE GIVING RAIN FALL AT CINCINNATI.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTALS.
1835	3.82	1.75	1.86	3.37	7.57	7.34	2.46	6.54	2.32	4.35	6.61	3.20	52.15
1836	2.97	4.34	4.18	4.54	9.01	2.14	7.42	5.54	4.77	3.71	4.41	4.36	57.39
1837	0.80	3.43	3.70	2.00	3.79	4.38	3.83	5.91	3.14	4.16	2.52	5.05	42.71
1838	1.90	1.64	0.56	4.74	8.57	7.55	2.47	3.76	0.71	3.55	3.12	0.85	39.45
1839	4.56	2.75	2.69	2.38	4.46	1.96	2.97	0.56	3.24	0.13	2.20	1.72	29.62
1840	1.13	4.68	3.62	4.78	6.08	6.84	4.45	3.73	1.56	4.74	2.50	3.20	47.34
1841	5.56	0.82	2.34	4.75	2.16	1.51	5.33	2.71	2.94	2.46	4.92	5.56	41.05
1842	2.75	6.09	3.02	2.97	3.04	5.67	2.35	4.22	2.95	1.90	3.76	2.57	41.29
1843	3.51	3.54	2.97	6.15	3.54	4.52	2.92	5.89	6.73	4.16	4.26	3.00	51.22
1844	3.10	1.04	4.50	3.13	7.00	6.16	3.50	3.65	1.26	4.32	3.18	1.10	41.94
1845	3.03	1.66	5.46	1.08	1.89	11.50	3.06	6.88	7.51	2.03	1.68	0.60	46.38
1846	3.59	3.20	2.26	3.51	5.17	7.53	3.93	6.10	2.50	2.19	4.26	9.25	53.52
1847	4.71	4.06	5.37	2.12	4.30	7.63	8.25	3.20	3.87	9.57	3.95	8.15	65.18
1848	4.58	2.81	6.72	0.55	5.13	1.86	6.95	3.90	1.53	3.62	2.60	9.43	49.68
1849	6.48	2.04	4.70	3.65	3.61	4.90	8.90	4.41	2.68	3.86	2.42	5.32	52.97
1850	5.20	6.28	6.62	4.27	1.86	5.00	6.30	7.20	2.22	1.05	2.54	6.22	54.76
1851	0.65	6.15	3.04	1.80	3.30	2.10	3.25	2.55	0.43	2.60	3.25	3.37	32.49
1852	2.03	5.20	5.16	5.80	3.15	5.25	2.05	4.35	4.15	2.75	4.57	9.89	54.35
1853	1.53	5.14	2.14	7.70	2.21	1.90	4.81	2.16	4.70	3.78	3.30	0.73	40.10
1854	4.10	5.57	8.33	2.97	7.29	4.84	2.32	3.18	2.12	3.01	3.66	3.38	50.69
1855	3.71	1.58	3.66	3.05	5.24	8.10	4.35	4.25	2.98	1.31	5.22	3.28	47.00
1856	1.00	2.49	1.51	0.72	1.23	2.24	3.43	0.61	3.62	1.74	2.09	2.19	22.87
1857	0.54	1.98	0.76	2.72	5.53	3.08	2.50	2.92	0.75	4.92	5.36	3.82	34.88
1858	2.06	1.74	1.05	4.34	8.32	5.69	3.01	7.97	0.85	4.66	2.57	6.41	48.67
1859	2.57	5.92	4.38	7.53	2.32	3.22	1.24	3.79	2.10	1.27	4.45	3.75	42.54
1860	1.43	1.56	0.41	5.31	3.68	1.55	7.96	0.92	4.33	1.28	3.53	1.85	33.81
1861	2.57	1.81	2.08	3.88	5.91	3.80	3.62	7.10	2.94	3.73	3.63	1.09	42.19
1862	4.74	2.36	5.84	6.30	3.82	3.02	3.00	1.49	0.93	0.80	3.97	3.01	38.78
1863	5.55	3.05	4.37	2.13	2.84	3.11	3.21	2.99	3.10	3.85	2.05	3.80	40.05
1864	1.85	0.99	0.90	2.43	2.34	3.43	1.25	3.42	8.64	2.90	3.40	2.94	34.50
1865	2.45	2.43	4.43	3.89	7.72	2.59	7.77	2.26	5.76	0.86	0.56	3.89	44.58
1866	2.74	1.26	5.06	2.03	0.94	4.44	6.94	2.75	10.55	1.85	3.06	1.98	43.60
1867	1.41	3.56	2.71	2.74	3.80	3.73	1.60	1.57	0.47	2.05	2.20	3.07	28.91
1868	3.72	0.57	4.87	2.72	6.09	5.60	1.21	4.04	7.19	1.22	1.70	2.07	41.60
1869	1.60	2.51	5.06	2.87	5.93	3.60	5.36	1.20	3.20	2.75	3.30	2.46	39.84
1870	5.33	1.55	3.26	1.59	1.74	4.84	2.38	0.58	0.30	2.77	1.50	2.17	28.03
1871	2.34	3.53	3.75	1.23	4.56	2.04	4.30	5.22	1.08	0.98	3.40	3.31	35.64
1872	0.85	1.75	1.59	5.56	2.48	3.20	8.00	3.19	1.39	2.64	1.00	0.89	32.54
1873	2.15	2.69	1.96	2.13	2.95	3.12	2.84	3.02	1.68	2.64	2 14	5.46	32.78
1874	3.37	4.40	3.03	5.23	1.15	2.25	3.47	1.05	1.69	0.98	4.42	2.34	33.38
1875	1.70	1.23	3.37	0.88	2.82	4.93	9.49	2.64	4.85	2.87	3.80	3.19	41.04
1876	9.49	2.92	5.07	3.26	1.25	6.67	6.91	6.38	3.17	4.26	2.36	0.88	52.62
1877	2.33	0.67	5.47	2.32	1.76	5.24	4.25	2.26	1.66	1.85	3.49	3.35	34.65
1878	4.33	2.33	4.03	3.05	2.53	5.03	4.32	4.11	2.84	2.39	2.77	3.89	41.62
1879	2.20	2.22	5.30	2.14	4.23	5.22	2.75	11.72	4.01	0.65	4.05	7.11	51.60
1880	5.14	4.50	4.15	5.82	5.70	9.87	2.46	4.01	1.37	2.98	4.42	4.26	54.67
1881	3.76	4.95	3.51	3.25	2.23	7.82	3.12	0.76	2.10	6.01	4.06	5.67	47.24
1882	6.02	7.04	6.17	2.71	8.47	4.34	2.91	5.75	3.16	1.59	1.57	2.39	52.12
1883	2.82	8.22	3.48	3.72	5.49	3.61	2.21	2.10	1.83	8.39	4.87	5.61	52.35
1884	2.21	8.87	2.63	3.02	5.56	2.77							25.06
M'ns	3.12	3.38	3.85	3.47	4.28	4.53	3.96	3.83	2.99	2.94	3.27	3.71	43 33

TABLE OF HIGH WATER IN THE OHIO RIVER AT CINCINNATI.

YEAR.	DATE.	FEET.	INCHES.
1832	February 18,	64	3
1847	December 17,	63	7
1858	June 16,	43	10
1859	February 22,	55	5
1860	April 16,	49	2
1861	April 19,	49	5
1862	January 24,	57	4
1863	March 12,	42	9
1864	December 23,	45	1
1865	March 7,	56	3
1866	September 26.	42	6
1867	March 14,	55	8
1868	March 30,	48	3
1869	April 2,	48	9
1870	January 19,	55	3
1871	May 13,	40	6
1872	April 13,	41	9
1873	December 18,	44	5
1874	January 11,	47	11
1875	August 6,	55	5
1876	January 29,	51	9
1877	January 20,	55	9
1878	December 15.	41	5
1879	December 27,	42	9
1880	February 17,	53	2
1881	February 16,	50	7
1882	February 21,	58	7
1883	February 15—5 A. M.	66	4
1883	April 13,	46	3
1883	December 28,	49	5
1884	February 14,	71	0¾
1884	March 17.	49	8

The great basin of the Ohio River and its tributaries may be likened to an immense funnel, whose area is considerably more than 50,000 square miles. From the north this basin has only a slight fall, while from the headwaters and the south the slope is very rapid. Water poured into this funnel affects the outlet most markedly when precipitated upon the regions about the headwaters and on the southern slope. So that a part of the rapid fluctuations is due to the sudden flushings from the mountains by the Allegheny, Monongahela, Great Kanawha, Little Kanawha and Big Sandy Rivers. After a general rainfall throughout the basin, the mountain streams *run out*, and a large portion of their rise has been conveyed down

stream before the rise in the more sluggish rivers of the northern slope is ready to empty in. If it were not for this fact, overflows would be much more frequent than they really are, for, as we shall see further on, it is when under rare conditions that the rise from *both sides* of the river is emptied into it at the same time, that the disastrous floods occur. Let it be distinctly understood that the floods are directly connected with the amount of moisture precipitated thoughout the basin, and that the river, like the outlet of a funnel, overflows whenever the amount thrown down is greater than it can discharge.

Coming next to a consideration of the records of the various rises in the river, I shall consider all those above fifty feet, including those uncertain ones before the days of record, and beginning with the Indian legend "From hill to hill."

1774.— . . . . 63 feet + (?)

Some time in March, 1774, two brothers, Joseph and Samuel Martin, reached the mouth of the Big Kanawha, where they were detained by a remarkably high freshet in the Ohio.

1789. Remarkable freshet during the winter, which Judge Goforth says was 112 feet high.

1792. Flood with over 60 feet of water. The time of the year is not stated.

1815.	Another great flood. Time of year not mentioned.						
1832.	February 16th,	water	64	feet	3	inches.	
1847.	December 17th,	"	63	"	7	"	
1859.	February 22d,	"	55	"	5	"	
1862.	January 24th,	"	57	"	4	"	
1865.	March 7th,	"	56	"	3	"	
1867.	March 14th,	"	55	"	8	"	
1870.	January 19th,	"	55	"	3	"	
1875.	August 6th,	"	55	"	5	"	
1876.	January 29th,	"	51	"	9	"	
1877.	January 20th,	"	53	"	9	"	
1880.	February 17th,	"	53	"	2	"	
1881.	" 16th,	"	50	"	7	"	
1882.	" 21st,	"	58	"	7	"	
1883.	" 15th,	"	66	"	4	"	
1884.	" 14th,	"	71	"	$\frac{3}{4}$	"	

Among those floods before 1832, so far as record goes they are assigned to the winter and spring, so that they materially strengthen the position

which is deducible from a statistical consideration of the record of the past fifty-two years.

The total number of floods from 1832 to 1884 inclusive, reaching above 50 feet of water in the channel, is fifteen, or one every three and a half years, on the average.

One occurred in 1875 under continued and unusual rainfall (very exceptional conditions), in August.

One occurred in December, 1847.

Two occurred in March, 1865, 1867.

Four occurred in January, 1862, 1870, 1876, 1877.

All the remaining seven occurred in the month of February.

A period, embracing from December 15th to March 15th, includes all the floods but one for the whole period of fifty-two years; while a shorter period, from January 15th to March 1st, includes all but four. December, January, February and March are the months of the year when the floods are to be looked for, and in this seasonal differentiation, so strongly marked by the record for more than fifty years, we must look for a factor which, when added to the amount of rainfall, will aid us to the solution of the problem.

We have this factor in the agency of cold. It precipitates moisture in the form of snow, allows it to thus accumulate in immense banks in mountains and valleys; throughout the entire basin vast quantities are thus piled up. The ground beneath is also frozen, and thus becomes impervious to water, which can not disappear in it.

The third and great factor is to be found from a careful study of meteorological observations, which have been compiled in recent years through our valuable Signal Service. A very valuable pamphlet upon the weather, by S. S. Bassler, Esq., has recently been published in Cincinnati, and it especially points out the fact that storms are areas of low barometer, which travel along broad, through pretty distinct and well-beaten paths. The Ohio Valley is the track of storms from the Gulf of Mexico and from the great Northwest. During the winter months this is especially true. One or two cold storms, with snow from the Northwest, are followed by warm storms with rain from the Gulf. Thus we find ourselves in the track of both cold and warm storms; and so constant and sudden is the predominance of first one, and then the other, that we are in a climate of perpetual and rapid change.

The conditions as regard banked snow are often present for a flood. You will all recall that upon December 22, 1883, a great amount of snow fell. It was settled by several inches of fine hail, so that the amount of con-

gealed moisture spread over the Ohio Valley was very great. On Sunday, December 23, a warm wave with rain from the Gulf came. Everything was favorable for a great flood. Had that warm wave lasted long enough and continued to pour its rain down upon the snow, a flood would have resulted. Luckily a cold wave from the Northwest came, predominated over the warm one from the Gulf, precipitated its moisture as snow, froze up the rain, stopped the melting, and the danger for that time passed.

This very snow formed the groundwork of our present flood. Throughout January more snow was added, with only slight thaws between, until over three feet of snow had fallen, and, for the most part, accumulated over the whole Ohio Valley. At last the warm storms from the Gulf and Southwest, superabundantly laden with rain, came. Day after day they rained out their warm torrents upon the snow accumulation, until many inches of rain were added to the melting snow. In vain did we look for our cold storm to call halt upon the gush of rain and melting snow. Strong were the hopes for a cold snap to stop with its icy fingers the dangers with which we were threatened. For fourteen days no sun cast a gleam of cheer. All the conditions were here; excessive rainfall, accumulated snow from cold waves, and continued warm air from the South, and the flood came, as I believe, more as a result of the combination of these conditions than anything else.

A recent number of *Puck*, catching the popular craze, has illustrated the forestry idea with peculiar vividness. Let us cast a glance for a moment at this idea. It has been the misfortune of the writer to witness a great overflow in the Rhine in 1882, and yet there is no country of the globe so particular or so scientific about public forests and forestry as Germany, where a certain area is set apart, proportioned upon the best known principles of forestry, and forests are cultivated thereon; and if, by chance of nature, a tree is blown down or rots away, its place is immediately supplied by another young one. In 1882, the writer also saw one of the greatest overflows in the history of the Danube River. Its headwaters are in Germany, and Austria is about as particular as Germany about this forestry craze. The Po, also, in Italy, overflowed and inundated the surrounding country. Yet forestry prevails there, if not as perfect as in Germany, at least with as good results. The overflows of all those rivers were directly dependent upon the amount of moisture precipitated, and not upon the absence or presence of the forests or their attending influences.

Not only have forests not availed anything practical for the floods in these countries, but even the fluctuations of the Rhine and Rhone are removed beyond their influence, and come in summer and go in winter from

the melting or freezing of Alpine snows above the tree-line, where there are no trees to influence it, but where warm air can and does.

The annual inundations of the Nile, also, are due to the *direct rainfall during the wet season in that immense central lake basin of Africa* described by Livingston and Stanley. The dense tropical forests and impenetrable jungles there do not seem to stop the rise of precipitated waters, or aid the forestry planters in their theory that the forest acts like a sponge and foliage prevents the access of the sun's rays to evaporate. The impassable jungles of India, and the vast forests and foliage of that tropical climate, do not prevent the great rises in the Ganges, when the wet season pours down its rain. The same is true of the Amazon; so that turn where you will, you are confronted by the facts that the floods come from precipitated moisture—from rain or accumulated snow; that their extent depends upon the amount of moisture precipitated, coupled with the warm air to aid to melt that which is congealed, and not upon the forests or penetration of the sun's rays. What sun's rays did we have in our recent fourteen days of gloominess to aid in melting the snow faster? Yet it melted, and rapidly, too. What protection are foliage or trees to permeating warm air, like what we so often have in our warm waves? So far as the sponge-theory part is concerned, it amounts to this: the soil is the great sponge and vat; when its pores are frozen up, as it recently was here, and water is dropped on, it runs off like water from a duck's back; then one of the elements for a flood or, rather, rapid freshet is present. I do not believe that forests and foliage act as a sponge, except so far that they resemble one soaked, upon which if you pour water, it already being full, an equal amount of water escapes. The obstruction and friction which trees are to water running down hill is something; therefore, on the whole, the effect of forestry is slight, but has, I think, been greatly overestimated.

There is indisputable evidence that a large part of the Ohio Valley was once a prairie like Illinois, and that herds of buffalo roamed over it. There is also evidence that a larger population than the Indians, viz.: the Mound Builders, once occupied and probably cleared a portion of it. Parts of it which are now thickets were known as prairie-land to the early pioneers; yet under all these variations, we have no evidence that it was barren recently, or that the rises in the river were once more frequent or extensive than at present; all of which should have been the case if the *theory* of forestry is as true for the Ohio Valley as for Asia Minor. No! either the theory is wrong, and the present barrenness of Asia Minor is due to other causes, or the theory can not be applied to the two regions. Lastly, if the forests protect us from floods, why did they not do so in 1774, 1789, 1792,

and in other floods accounting for the Indian legend, "From hill to hill," occurring at a time when scarcely a tree in the Ohio Valley had been felled by the white man?

The great theory of forestry accounting for floods and drouths does not seem to hold good on our great Western prairies. Illinois, Iowa, Northern Missouri, Nebraska and Kansas, as well as the great Red River Valley of the North and the great Northwest prairies, seem to be particularly fertile, and as free from drouth as regions covered with the native forests in all their glory. Enough has been said already, however, to convince the most skeptical, and to keep the forest humbugs and schemers for political offices, under this new idea, busy preparing even plausible explanations in order to have the facts fit their theory.

The last fact to which attention is to be directed is the greater frequency of floods in recent years. Dividing the fifty-two years of record into two periods—the first twenty-six years yielded two floods, the last twenty-six thirteen floods, while for the last five years we have had one each year. The cultivation of the soil, with increasing outlay in tile-draining, certainly facilitates the discharge of water which the great surface-soil of the earth, as a sponge, has before held back, and the ever-increasing facility for outlets may, in a measure, account for this. Meteorological observation has not been of long enough duration to enable us to say whether cold and warm waves are more frequent now than formerly, and whether our climate is gradually changing or not. Yet the frequency of the floods in recent years certainly suggests such a possibility, and we may look forward with pleasure to the further accumulation of those records to determine that point.

A brief summary of the meteorological conditions and stages of the water during the flood of 1884, extracted from the Report to the Relief Committee of the Chamber of Commerce by R. B. Stevenson, Esq., is here appended:

"The meterological causes of the flood began on the 14th day of December, 1883, when the winter's first fall of snow occurred in the Ohio Valley, less than 1 inch in depth at Cincinnati, where the stage of the Ohio River was 10 feet 7 inches on that day, a minimum to which it did not again decline for a period of six months or more. To the snow, on the date named, was added rainfall to the depth of sixteen-hundredths of an inch. Light snows fell on the 15th, 16th, 18th, and 19th of December, followed by a heavier snow on the 20th, and twelve hours of snow on the 22d, the fall of the day last indicated measuring 6¾ inches in depth. The snow then on the ground was partly removed and partly more closely

packed by a fall of sleet and rain on the 23d that equaled a rainfall of 2.57 inches, after which the temperature became so cold that ice appeared in the river the following day, which disappeared on the 28th, under the influence of light rains which fell on the 27th. Light rains, but enough to carry much of the snow into the river, and solidify that which remained on the ground, fell also on the 30th and 31st. The total fall of snow, sleet, and rain, during the month of December, reduced to rainfall, was 5.61 inches. The highest stage of the river during the month was 49½ feet, on the 28th, when it began to decline.

"Light snows were frequent, and a cold temperature prevailed from the 1st to the 14th of January, 1884, when a heavy snow set in at 5 P. M., and continued until the following day, and on the 19th there was another light fall of snow. These alternated with sleet and rain, and the temperature varied, during the last five days, between zero and 60 degrees above. The first half of the month was generally cold, but there were slight variations in the weather conditions. These variations and other influences were sufficient to cause the river to fall, first, from 49½ feet on December 28th, to 15 feet 5 inches on January 13th, then rise to 24 feet 1 inch on the 19th, then fall to 15 feet 9 inches on the 29th, and rise again to 31 feet 3 inches on the 31st, when the flood of 1884 properly began. The 30th of January found upon the ground much of the previous fall of 18 inches to 4 feet of solidified snow, packed upon the hills and mountains and valleys of the Ohio River and its tributaries, and the smaller streams tributary to the latter. The depth of snow that fell at Cincinnati during the month of January was 10 inches, and much more had fallen at other localities that would affect the condition of the river. The rainfall of the month was 1.23 inches. The snow, sleet and rain, reduced to rainfall, was 2.21 inches. One rain followed another from the 30th of January to the 13th of February, which affected the river accordingly."

STAGES OF WATER, FEBRUARY, 1883–4.

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.	Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb.	1— 6 A.M.	29	1	36	4	Feb.	2— 3 A.M.			43	6
"	10 "			37	7½	"	6 "	28	5	44	4
"	11 "			38	½	"	7 "			44	8
"	12 Noon	29	5	38	4½	"	8 "			44	11½
"	1 P.M.			38	8	"	9 "			45	3
"	2 "			39	—	"	10 "			45	6
"	3 "			39	5½	"	11 "			45	8
"	4 "			39	9	"	12 Noon	28	3	45	10½
"	5 "			40	1½	"	1 P.M.			46	1½
"	6 "	29	1	40	5½	"	2 "			46	5
"	9 "			41	6	"	3 "			46	7
"	12 Midnight			42	6½	"	4 "			46	9½

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 2—	5 P.M.			46	11½
"	6 "	28	11	47	1
"	7 "			47	3½
"	8 "			47	5½
"	9 "			47	8
"	10 "			47	10
"	11 "			48	—
"	12 Midnight			48	2
Feb. 3—	6 A.M.	27	2	48	10½
"	8 "			49	½
"	9 "			49	1½
"	10 "			49	2½
"	11 "			49	4
"	12 Noon	27	—	49	4½
"	3 P.M.			49	6½
"	6 "	26	6	49	8
"	9 "			49	9½
"	12 Midnight			49	10½
Feb. 4—	3 A.M.			49	11
"	6 "	29	1	49	11
"	7 "			49	11½
"	8 "			49	11½
"	9 "			49	11
"	10 "			49	11
"	12 Noon	30	—	49	10½
"	1 P.M.			49	10½
"	2 "			49	10½
"	3 "			49	11
"	4 "			50	½
"	5 "			50	2
"	6 "	30	4	50	3
"	9 "			50	7½
"	12 Midnight			51	½
Feb. 5—	3 A.M.			51	4½
"	6 "	30	2	51	7½
"	7 "			51	8½
"	8 "			51	9
"	9 "			51	10
"	10 "			51	11
"	10:30 A.M.			52	—
"	11 "			52	2
"	11:30 "			52	3
"	12 Noon	30	5	52	4½
"	12:30 P.M.			52	5½
"	1 "			52	7
"	1:30 "			52	8½
"	2 "			52	9½
"	2:30 "			52	11
"	3 "			53	—
"	3:30 "			53	1½
"	4 "			53	2½
"	4:30 "			53	3½
"	5 "			53	4½
"	5:30 "			53	5½
"	6 "	30	6	53	6½
"	7 "			53	8½
"	8 "			53	10½
Feb. 5—	9 P.M.			54	2
"	10 "			54	6
"	11 "			54	10
"	12 Midnight			55	3
Feb. 6—	1 A.M.			55	7
"	2 "			55	11
"	3 "			56	2
"	4 "			56	7
"	5 "			56	11½
"	6 "	29	5	57	3½
"	7 "			57	7
"	7:30 A.M.			57	9
"	8 "			57	11
"	8:30 "			58	½
"	9 "			59	2
"	9:30 "			58	4
"	10 "			58	5½
"	10:30 "			58	7
"	11 "			58	9
"	11:30 "			58	11
"	12 Noon	29	5	59	—
"	12:30 P.M.			59	2
"	1 "			59	3½
"	1:30 "			59	5
"	2 "			59	7½
"	2:30 "			59	9
"	3 "			59	9
"	3:30 "			59	10
"	4 "			59	11
"	4:30 "			59	11
"	5 "			60	1
"	5:30 "			60	2
"	6 "	29	10	60	3
"	6:30 "			60	4½
"	7 "			60	5
"	7:30 "			60	6
"	8 "			60	6½
"	8:30 "			60	7½
"	9 "			60	8½
"	9:30 "			60	9
"	10 "			60	9½
"	10:30 "			60	10
"	11 "			60	11
"	11:30 "			60	11½
"	12 Midnight			61	—
Feb. 7—	12:30 A.M.			61	—
"	1 "			61	—
"	1:30 "			61	½
"	2 "			61	1
"	2:30 "			61	2
"	3 "			61	2
"	3:30 "			61	2½
"	4 "			61	3½
"	4:30 "			61	3½
"	5 "			61	4
"	5:30 "			61	4½
"	6 "	39	4	61	4½

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 7—	6:30 P.M.			61	5¼
“	7 “			61	5½
“	8:30 “			61	6
“	9 “			61	6½
“	9:30 “			61	6¾
“	10 “			61	6¾
“	10:30 “			61	7
“	11 “			61	7¼
“	11:30 “			61	7½
“	12 Noon	42	8	61	7¾
“	12:30 P.M.			61	8
“	1 “			61	8¼
“	1:30 “			61	8¼
“	2 “	44	2	61	8½
“	2:30 “			61	8½
“	3 “	44	10	61	8½
“	3:30 “			61	9
“	4 “	45	2	61	9
“	4:30 “			61	9
“	5 “	45	7	61	9½
“	5:30 “			61	9½
“	6 “	46	3	61	9½
“	6:30 “			61	9½
“	7 “	47	—	61	9½
“	7:30 “			61	9½
“	8 “	48	—	61	9½
“	8:30 “			61	9½
“	9 “			61	9½
“	9:30 “			61	9¾
“	10 “			61	10
“	10:30 “			61	10¼
“	11 “			61	10¼
“	11:30 “			61	10½
“	12 Midnight	48	9	61	10¾
Feb. 8—	12:30 A.M.			61	11
“	1 “			61	11¼
“	1:30 “			61	11¾
“	2 “	49	6	62	—
“	2:30 “			62	¼
“	3 “			62	½
“	3:30 “			62	¾
“	4 “	50	3	62	1
“	4:30 “			62	1¼
“	5 “			62	1½
“	5:30 “			62	1¾
“	6 “	50	10	62	2
“	6:30 “			62	2¼
“	7 “			62	3
“	7:30 “			62	3½
“	8 “	51	5	62	3½
“	8:30 “			62	4
“	9 “	51	7	62	4½
“	9:30 “			62	4½
“	10 “	51	10	62	5½
“	10:30 “			62	5½
“	11 “	52	2	62	5¾
“	11:30 “			62	6
Feb. 8—	12 Noon	52	5	62	6½
“	12:30 P.M.	52	6½	62	6½
“	1 “	52	8	62	7
“	1:30 “	52	9½	62	7
“	2 “	52	11	62	7½
“	2:30 “	53	½	62	7½
“	3 “	53	3	62	8½
“	3:30 “	53	4	62	8½
“	4 “	53	5	62	9
“	4:30 “	53	6½	62	9½
“	5 “	53	8	62	9½
“	5:30 “	53	9½	62	9½
“	6 “	53	10½	62	10½
“	6:30 “			62	10¼
“	7 “	54	2	62	11
“	7:30 “			62	11¼
“	8 “	54	4½	62	11½
“	8:30 “			62	11¾
“	9 “	54	7	63	—
“	9:30 “			63	¼
“	10 “	54	9½	63	½
“	10:30 “			63	¾
“	11 “	55	—	63	1
“	11:30 “			63	1¼
“	12 Midnight	55	3	63	1½
Feb. 9—	12:30 A.M.			63	1¾
“	1 “	55	5	63	2
“	1:30 “			63	2¼
“	2 “	55	7½	63	2½
“	2:30 “			63	2¾
“	3 “	55	10	63	3
“	3:30 “			63	3¼
“	4 “	56	—	63	3½
“	4:30 “			63	3¾
“	5 “	56	2½	63	4
“	5:30 “			63	4½
“	6 “	56	4	63	4¾
“	6:30 “	56	4½	63	5
“	7 “	56	5½	63	5½
“	7:30 “	56	6½	63	5½
“	8 “	56	7½	63	6
“	8:30 “	56	8½	63	6½
“	9 “	56	9½	63	6½
“	9:30 “	56	10½	*63	7
“	10 “	56	11½	63	7½
“	10:30 “	57	—	63	7½
“	11 “	57	½	63	7½
“	11:30 “	57	1	63	8
“	12 Noon	57	2	63	8½
“	12:30 P.M.	52	3	63	8½
“	1 “	57	3½	63	9
“	1:30 “	57	4	63	9
“	2 “	57	5	63	9½
“	2:30 “	57	6	63	9½
“	3 “	57	6½	63	10

* Flood height December 17th, 1847.

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 9—	3:30 P.M.	57	7	63	10
"	4 "	57	8	63	10½
"	4:30 "	57	8½	63	10½
"	5 "	57	9	63	11
"	5:30 "	57	10	63	11¼
"	6 "	57	10	64	—
"	6:30 "			64	¼
"	7 "	57	11½	64	½
"	7:30 "			64	¾
"	8 "	58	½	64	1
"	8:30 "			64	1¼
"	9 "	58	2	64	1½
"	9:30 "			64	1¾
"	10 "	58	3	64	2
"	10:30 "			64	2¼
"	11 "	58	4	64	2½
"	11:30 "			64	2¾
"	12 Midnight	58	5	*64	3
Feb. 10—	12:30 A.M.			64	3¼
"	1 "	58	6	64	3½
"	1:30 "			64	3¾
"	2 "	58	7	64	4
"	2:30 "			64	4¼
"	3 "	58	8	64	4½
"	3:30 "			64	5
"	4 "	58	9	64	5¼
"	4:30 "			64	5¾
"	5 "	58	9½	64	6
"	5:30 "			64	6½
"	6 "	58	9½	64	7
"	6:30 "	58	9½	64	7½
"	7 "	58	9½	64	8
"	7:30 "	58	10	64	8
"	8 "	58	10	64	8½
"	8:30 "	58	10	64	8½
"	9 "	58	10½	64	9
"	9:30 "	58	10¾	64	9
"	10 "	58	11	64	9½
"	10:30 "	58	11¼	64	9½
"	11 "	58	11¾	64	10
"	11:30 "	59	—	64	10
"	12 Noon	59	¼	64	10½
"	12:30 P.M.	59	½	64	10½
"	1 "	59	½	64	10¾
"	1:30 "	59	¾	64	11¼
"	2 "	59	¾	64	11½
"	2:30 "	59	1	64	11¾
"	3 "	59	1	64	11¾
"	3:30 "	59	1¼	65	—
"	4 "	59	1½	65	—
"	4:30 "	59	1½	65	¼
"	5 "	59	1¾	65	½
"	5:30 "	59	2	65	¾
"	6 "	59	2¼	65	1
"	6:30 "	59	2½	65	1½

*Flood height February 18th, 1832.

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 10—	7 P.M.	59	2½	65	1¼
"	7:30 "	59	2½	65	2
"	8 "	59	3	65	2¼
"	8:30 "	59	3	65	2½
"	9 "	59	3½	65	2¾
"	9:30 "			65	3
"	10 "	59	3¾	65	3¼
"	10:30 "			65	3½
"	11 "	59	4	65	3¾
"	11:30 "			65	4
"	12 Midnight	59	4¾	65	4¼
Feb. 11—	12:30 A.M.			65	4½
"	1 "	59	5¼	65	4½
"	1:30 "			65	4¾
"	2 "	59	6	65	5½
"	2:30 "			65	5¾
"	3 "	59	6¾	65	6
"	3:30 "			65	6½
"	4 "	59	7½	65	7
"	4:30 "			65	7½
"	5 "	59	8¾	65	8
"	5:30 "			65	8½
"	6 "	59	9¾	65	9
"	6:30 "	59	10¼	65	9¾
"	7 "	59	10¾	65	10
"	7:30 "	59	11¼	65	10½
"	8 "	59	11¾	65	11
"	8:30 "	60	¼	65	11½
"	9 "	60	1½	66	—
"	9:30 "	60	1¾	66	½
"	10 "	60	2½	66	¾
"	10:30 "	60	4	66	1¼
"	11 "	60	5	66	1¼
"	11:30 "	60	6	66	2½
"	12 Noon	60	7	66	2¾
"	12:30 P.M.	60	8	66	3
"	1 "	60	9	66*	4½
"	1:30 "	60	10	66	5
"	2 "	60	11	66	5½
"	2:30 "	61	½	66	6
"	3 "	61	1½	66	6½
"	3:30 "	61	2½	66	7
"	4 "	61	3½	66	7½
"	4:30 "	61	4	66	8½
"	5 "	61	5	66	9
"	5:30 "	61	6	66	9¾
"	6 "	61	8	66	10
"	6:30 "	61	8	66	10½
"	7 "	61	9	66	11
"	7:30 "	61	9½	66	11½
"	8 "	61	10	67	—
"	8:30 "			67	½
"	9 "	62	—	67	1
"	9:30 "			67	1½
"	10 "	62	1	67	2

* Above flood height February 15th, 1883.

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 11—	10:30 P.M.			67	2½
"	11 "	62	2½	67	3
"	11:30 "			67	3½
"	12 Midnight	62	4½	67	4
Feb. 12—	12:30 A.M.			67	4¾
"	1 "	62	6	67	5¼
"	1:30 "			67	5¾
"	2 "	62	7	67	6½
"	2:30 "			67	7
"	3 "	62	8½	67	7¼
"	3:30 "			67	7¾
"	4 "	62	9½	67	8
"	4:30 "			67	8¼
"	5 "	62	10¾	67	8¾
"	5:30 "			67	9¼
"	6 "	62	11¾	67	9¾
"	6:30 "			67	10½
"	7 "	63	1	67	11
"	7:30 "	63	2	68	—
"	8 "	63	3	68	—
"	8:30 "	63	3¾	68	½
"	9 "	63	4¼	68	1
"	9:30 "	63	4¼	68	1½
"	10 "	63	4¼	68	1¾
"	10:30 "	63	4¾	68	2¼
"	11 "	63	5	68	2½
"	11:30 "	63	5¾	68	3
"	12 Noon	63	6¼	68	3½
"	12:30 P.M.	63	7	68	4
"	1 "	63	7¼	68	4½
"	1:30 "	63	7½	68	5
"	2 "	63	8	68	5
"	2:30 "	63	8¼	68	5½
"	3 "	63	8¾	68	6
"	3:30 "	63	9	68	6½
"	4 "	63	9	68	7
"	4:30 "	63	9¾	68	7½
"	5 "	63	10	68	8
"	5:30 "	63	10½	68	8¼
"	6 "	63	11	68	8¼
"	6:30 "	63	11½	68	8½
"	7 "	64	—	68	8¾
"	7:30 "			68	9
"	8 "	64	1	68	9¼
"	8:30 "			68	9½
"	9 "	64	2	68	10
"	9:30 "			68	10¼
"	10 "	64	2¾	68	10½
"	10:30 "			68	10¾
"	11 "	64	3½	68	11¼
"	11:30 "			68	11½
"	12 Midnight	64	4¼	69	—
Feb. 13—	12:30 A.M.			69	¼
"	1 "	64	5	69	1
"	1:30 "			69	1½
"	2 "	64	5½	69	1¾
"	2:30 "			69	2¼
Feb. 13—	3 A.M.	64	6¼	69	2½
"	3:30 "			69	3
"	4 "	64	7½	69	3¼
"	4:30 "			69	4
"	5 "	64	8	69	4¼
"	5:30 "			69	4½
"	6 "	64	8¼	69	5
"	6:30 "	64	8½	69	5½
"	7 "	64	8¾	69	6
"	7:30 "	64	9¼	69	6½
"	8 "	64	9½	69	6¾
"	8:30 "	64	10	69	7¼
"	9 "	64	10¼	69	7¾
"	9:30 "	64	10½	69	8
"	10 "	64	10¾	69	8¼
"	10:30 "	64	10¾	69	9
"	11 "	64	11	69	9¼
"	11:30 "	64	11¼	69	9½
"	12 Noon	64	11½	69	10
"	12:30 P.M.	64	11½	69	10¼
"	1 "	64	11¾	69	10½
"	1:30 "	64	11¾	69	11
"	2 "	65	—	69	11
"	2:30 "	65	—	69	11½
"	3 "	65	¼	69	11½
"	3:30 "	65	½	69	11¾
"	4 "	65	½	70	—
"	4:30 "	65	½	70	½
"	5 "	65	½	70	½
"	5:30 "	65	½	70	¾
"	6 "	65	1	70	¾
"	6:30 "	65	1	70	¾
"	7 "	65	1	70	1
"	7:30 "			70	1½
"	8 "	65	1	70	1¾
"	8:30 "			70	2¼
"	9 "	65	1	70	2¾
"	9:30 "			70	3¼
"	10 "	65	1	70	3¾
"	10:30 "			70	4½
"	11 "	65	1	70	5
"	11:30 "			70	5¾
"	12 Midnight	65	½	70	6½
Feb. 14—	12:30 A.M.			70	7
"	1 "	65	½	70	7½
"	1:30 "			70	8
"	2 "	65	½	70	8½
"	2:30 "			70	9
"	3 "	65	¼	70	9½
"	3:30 "			70	10
"	4 "	65	—	70	10¼
"	4:30 "			70	10¼
"	5 "	64	11½	70	10½
"	5:30 "			70	10¾
"	6 "	64	11¼	70	10¾
"	6:30 "			70	11
"	7 "	64	11	70	11½

		1883.		1884.	
Date.	Time.	Ft.	In.	Ft.	In.
Feb. 14—	7:30 "	64	11	70	11¾
"	8 "	64	10¼	71	—
"	8:30 "	64	10¾	71	—
"	9 "	64	10¾	71	—
"	9:30 "	64	11	71	—
"	10 "	64	11½	71	*¼
"	10:30 "	64	11¾	71	¼
"	11 "	65	¼	71	¼
"	11:30 "	65	¾	71	½
"	12 Noon	65	1½	*71	¾
"	12:30 P.M.	65	2	*71	¾
"	1 "	65	3	*71	¾
"	1:30 "	65	3¾	*71	¾
"	2 "	65	4½	71	½
"	2:30 "	65	5	71	½
"	3 "	65	6	71	½
"	3:30 "	65	7	71	½
"	4 "	65	7¾	71	½
"	4:30 "	65	8½	71	½
"	5 "	65	9	71	½
"	5:30 "	65	9¾	71	½
"	6 "	65	10½	71	½
"	6:30 "	65	11	71	½
"	7 "	65	11½	71	—
"	7:30 "			70	11¾
"	8 "	66	½	70	11½
"	8:30 "			70	11¼
"	9 "	66	¾	70	11¼
"	9:30 "			70	11
"	10 "	66	1¾	70	11
"	10:30 "			70	10¾
"	11 "	66	2¼	70	10½
"	11:30 "			70	10
"	12 Midnight	66	2¾	70	10
Feb. 15—	12:30 A.M.			70	9½
"	1 "	66	3¼	70	9¼
"	1:30 "			70	9¾
"	2 "	66	3	70	9¼
"	2:30 "			70	9
"	3 "	66	3½	70	8½
"	3:30 "			70	8¼
"	4 "	†66	4	70	7¾
"	4:30 "			70	7½
"	5 "	†66	4	70	7
"	5:30 "			70	6¾
"	6 "	66	3¾	70	6½
"	6:30 "			70	6
"	7 "	66	3½	70	5¾
"	7:30 "	66	3¾	70	5
"	8 "	66	3½	70	5
"	8:30 "	66	3¼	70	4½
"	9 "	66	3	70	4
"	9:30 "	66	2¾	70	3½
"	10 "	66	2½	70	3½
"	10:30 "	66	2½	70	3

		1883.		1884.	
Date.	Time.	Ft.	In.	Ft.	In.
Feb. 15—	11 A.M.	66	2½	70	2½
"	11:30 "	66	2¼	—	—
"	12 Noon	66	1¾	70	2
"	12:30 P.M.	66	1½	70	2
"	1 "	66	1¼	70	2
"	1:30 "	66	1	70	1
"	2 "	66	½	70	½
"	2:30 "	66	—	70	—
"	3 "	65	11¾	70	—
"	3:30 "	65	11½	69	11½
"	4 "	65	11¼	69	11¼
"	4:30 "	65	10¾	69	10¾
"	5 "	65	10¾	69	10¾
"	5:30 "	65	10¾	—	—
"	6 "	65	10¾	69	10¼
"	6:30 "	65	10½	69	10
"	7 "	65	9½	69	9½
"	7:30 "			69	9
"	8 "	65	8	69	8¾
"	8:30 "			69	8¼
"	9 "	65	6¾	69	7¾
"	9:30 "			69	7¼
"	10 "	65	5¾	69	7
"	10:30 "			69	6½
"	11 "	65	4¾	69	6¼
"	11:30 "			69	6
"	12 Midnight	65	3¾	69	5½
Feb. 16—	12:30 A.M.			69	5¼
"	1 "	65	2½	69	5
"	1:30 "			69	4¾
"	2 "	65	1½	69	4¼
"	2:30 "			69	3¾
"	3 "	65	½	69	3
"	3:30 "			69	2½
"	4 "	64	11¾	69	2
"	4:30 "			69	1
"	5 "	64	11	69	½
"	5:30 "			69	—
"	6 "	64	10	68	11
"	6:30 "			68	10½
"	7 "	64	9	68	10
"	7:30 "	64	8	68	9½
"	8 "	64	7½	68	9
"	8:30 "	64	7½	68	8½
"	9 "	64	6½	68	8
"	9:30 "	64	6	68	7½
"	10 "	64	5½	68	7
"	10:30 "	64	5½	68	7
"	11 "	64	4½	68	6¼
"	11:30 "	64	4½	68	5¾
"	12 Noon	64	4½	68	5½
"	12:30 P.M.	64	3	68	5
"	1 "	64	3	68	4½
"	1:30 "	64	2	68	4
"	2 "	64	2	68	3½
"	2:30 "	64	1½	68	3
"	3 "	64	½	68	2½

* Flood height of 1884.
† Flood height of 1883.

Date.	Time.	1883.		1884.	
		Ft.	In.	Ft.	In.
Feb. 16—	3:30 P.M.	64	—	68	2
"	4 "	63	11½	68	1½
"	4:30 "	63	10¾	68	1
"	5 "	63	10	68	½
"	5:30 "	63	10	67	11½
"	6 "	63	9½	67	11
"	6:30 "			67	11
"	7 "	63	9	67	10½
"	7:30 "			67	10
"	8 "	63	8	67	9½
"	8:30 "			67	9
"	9 "	63	6	67	8½
"	9:30 "			67	8
"	10 "	63	5	67	7½
"	10:30 "			67	7
"	11 "	63	4	67	6½
"	12 Midnight	63	3	67	6
Feb. 17—	12:30 A.M.			67	4¾
"	1 "	63	2	67	4
"	1:30 "			67	3¾
"	2 "	63	1½	67	2½
"	2:30 "			67	1¾
"	3 "	63	1½	67	1
"	3:30 "			67	½
"	4 "	62	11¾	66	11¾
"	4:30 "			66	11
"	5 "	62	11	66	10½
"	5:30 "	62	11	66	9¾
"	6 "	62	10	66	9
"	6:30 "	62	10	66	8½
"	7 "	62	9½	66	8
"	8 "	62	7	—	—
"	8:30 "			66	7
"	9 "	62	6	66	6
"	9:30 "			66	5
"	10 "	62	5½	66	4¼
"	10:30 "			66	4¼
"	11 "	62	5	66	3¾
"	11:30 "			66	3
"	12 Noon	62	4	66	2¼
"	12:30 P.M.			66	1¾
"	1 "	62	2½	66	¾
"	1:30 "			66	—
"	2 "	62	1¾	65	11½
"	2:30 "			65	11
"	3 "	62	1	65	10
"	3:30 "			65	9½
"	4 "	61	11½	65	9
"	4:30 "			65	8½
"	5 "	61	11	65	7½
"	5:30 "			65	6¾
"	6 "	61	10	65	6
"	6:30 "			65	5½
"	7 "	61	9	65	5
"	7:30 "			65	4½
"	8 "	61	8	65	4
"	8:30 "			65	3½
Feb. 17—	9 P.M.	61	7	65	2¼
"	9:30 "			65	2¼
"	10 "	61	6	65	1½
"	10:30 "			65	1
"	11 "	61	5	65	—
"	11:30 "			64	11½
"	12 Midnight	61	4	64	11
Feb. 18—	12:30 A.M.			64	10½
"	1 "	61	3	64	10
"	1:30 "			64	9½
"	2 "	61	2	64	9
"	2:30 "			64	8¼
"	3 "	61	1	64	7½
"	3:30 "			64	7
"	4 "	61	—	64	6¼
"	4:30 "			64	5½
"	5 "	60	11	64	4½
"	5:30 "			64	3½
"	6 "	60	10	64	2½
"	6:30 "			64	2
"	7 "	60	9¼	64	1½
"	8 "	60	8	63	11½
"	9 "	60	7	63	10½
"	10 "	60	6	63	9
"	11 "	60	5½	63	7
"	11:30 "			63	6½
"	12 Noon	60	5	63	5½
"	1 P.M.	60	4	63	5
"	1:30 "			63	3
"	2 "	60	3	63	2½
"	3 "	60	2	63	2
"	3:30 "			63	½
"	4 "	60	1	63	—
"	5 "	60	—	62	11
"	6 "	59	11	62	9½
"	6:30 "			62	8
"	7 "	59	10½	62	8
"	7:30 "			62	7
"	8 "	59	10	62	6
"	8:30 "			62	5½
"	9 "	59	9½	62	4½
"	9:30 "			62	4
"	10 "	59	9	62	3
"	10:30 "			62	2½
"	11 "	59	8½	62	1½
"	11:30 "			62	1
"	12 Midnight	59	8	62	—
Feb. 19—	12:30 A.M.			61	11
"	1 "	59	7½	61	9½
"	1:30 "			61	8½
"	2 "	59	7	61	8
"	2:30 "			61	7½
"	3 "	59	6½	61	6½
"	3:30 "			61	6
"	4 "	59	5¾	61	5
"	4:30 "			61	4½
"	5 "	59	5	61	3

Date.	Time.	1883. Ft.	1883. In.	1884. Ft.	1884. In.
Feb. 19—	5:30 A.M.			61	2½
"	6 "	59	4	61	2
"	6:30 "			61	1
"	7 "	59	3	61	—
"	7:30 "			60	11
"	8 "	59	3	60	10½
"	9 "	59	3	60	9
"	10 "	59	2	60	7½
"	11 "	59	1	60	6
"	12 Noon	59	—	60	4
"	1 P.M.	58	11½	60	3
"	2 "	58	10½	60	1
"	3 "	58	9½	60	—
"	4 "	58	9	59	11
"	5 "	58	8	59	10½
"	6 "	58	8	59	10
"	7 "	58	8	59	9½
"	8 "	58	7	59	9¼
"	9 "	58	6	59	9½
"	10 "	58	5	59	9½
"	11 "	58	5	59	9
"	12 Midnight	58	4½	59	8½
Feb. 20—	1 A.M.	58	4	59	7½
"	2 "	58	3½	59	7
"	3 "	58	3	59	6½
"	4 "	58	2½	59	6
"	5 "	58	2	59	5½
"	6 "	58	1½	59	5
"	7 "	57	10	59	4
"	8 "	57	10	59	3½
"	9 "	57	10	59	3
"	10 "	57	9	59	2
"	11 "	57	8	59	1
"	12 Noon	57	7	59	—
"	1 P.M.	57	6½	58	11
"	2 "	57	5½	58	9
"	3 "	57	5	58	8
"	4 "	57	4	58	7
"	5 "	57	3½	58	6
"	6 "	57	3	58	5
"	7 "	57	2	58	4
"	8 "	57	1	58	2
"	9 "	57	½	58	—
"	10 "	57	—	57	10
"	11 "	56	11½	57	8
"	12 Midnight	56	11	57	6
Feb. 21—	1 A.M.	56	10½	57	4
"	2 "	56	10	57	2½
"	3 "	56	9¼	57	1
"	4 "	56	8½	57	—
"	5 "	56	7	56	11
"	6 "	56	6½	56	9½
"	7 "	56	5	56	7½
"	8 "			56	5½
"	9 "	56	4½	56	4
"	10 "	56	½	56	2½
"	11 "	55	11	56	—
Feb. 21—	12 Noon	55	10	55	10
"	1 P.M.	55	9	55	8
"	2 "	55	8	55	7
"	3 "	55	7	55	5
"	4 "	55	6	55	4½
"	5 "	55	5	55	1½
"	6 "	55	4	54	11
"	7 "	55	3	54	10
"	8 "	55	2	54	9
"	9 "	55	1	54	7½
"	10 "	55	—	54	5½
"	11 "	54	11	54	3½
"	12 Midnight	54	10	54	1
Feb. 22 —	1 A.M.	54	9	53	11
"	2 "	54	8	53	9
"	3 "	54	6	53	7
"	4 "	54	4½	53	4½
"	5 "	54	3	53	2½
"	6 "	54	1½	53	½
"	7 "	53	11	52	10½
"	8 "	53	10	52	9
"	9 "	53	9	52	8
"	10 "	53	8	52	6½
"	11 "	53	7	52	4½
"	12 Noon	53	6	52	2½
"	1 P.M.	53	5	52	½
"	2 "	53	3½	51	10½
"	3 "	53	2	51	9
"	4 "	53	1	51	7½
"	5 "	53	—	51	7½
"	6 "	52	11	51	5
"	7 "			51	2
"	8 "			51	—
"	9 "	52	4	50	10½
"	10 "			50	9
"	11 "			50	7
"	12 Midnight	51	10	50	5
Feb. 23—	1 A.M.			50	4
"	2 "			50	2
"	3 "	51	6	50	½
"	4 "			49	11
"	5 "			49	9½
"	6 "	51	1	49	8
"	7 "			49	6
"	8 "			49	4
"	9 "	50	—	49	2
"	10 "			49	—
"	11 "	49	8	48	10
"	12 Noon	49	6	48	8
"	1 P.M.	49	4	48	6
"	2 "			48	4
"	3 "	49	1	48	2½
"	4 "			48	—
"	5 "			47	11
"	6 "	48	7	47	10
"	7 "			47	9
"	8 "			47	7½

Date.	Time.	1883. Ft.	In.	1884. Ft.	In.
Feb. 23—	9 P.M.	48	3	47	6
"	10 "			47	4
"	11 "			47	2
"	12 Midnight	47	9	47	—
Feb. 24—	1 A.M.			46	10
"	2 "			46	9
"	3 "	47	—	46	7½
"	4 "			46	6
"	5 "			46	4½
"	6 "	46	4	46	3
"	7 "			46	2
"	8 "			46	½
"	9 "			45	10½
"	10 "			45	8½
"	11 "			45	7
"	12 Noon	45	1	45	5
"	1 P.M.			45	3
"	2 "			45	1½
"	3 "			45	—
"	4 "			44	10½
"	5 "			44	9
"	6 "	44	—	44	7½
"	7 "			44	4½
"	8 "			44	2½
Feb. 24—	9 P.M.			44	—
"	10 "			43	10
"	11 "			43	8
"	12 Midnight			43	6
Feb. 25—	6 A.M.	42	8	42	10
"	7 "			42	—
"	8 "			41	10
"	9 "			41	7½
"	10 "			41	5½
"	11 "			41	3
"	12 Noon	42	1	41	1
"	6 P.M.	41	2	40	2
Feb. 26—	6 A.M.	39	11	38	1
"	12 Noon	37	11	37	1
"	6 P.M.	37	—	36	—
Feb. 27—	6 A.M.	34	10	34	1
"	12 Noon	34	5	33	2
"	6 P.M.	33	10	33	—
Feb. 28—	6 A.M.	32	4	30	3
"	12 Noon	31	10	29	7
"	6 P.M.	30	2	28	4
Feb. 29—	6 A.M.			27	3
"	12 Noon			25	6
"	6 P.M.			25	—

THE FUCOIDS OF THE CINCINNATI GROUP.

By Joseph F. James,

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The induction philosophy of Lord Bacon is the guiding philosophy of science. This scientific method teaches us to argue from particulars to generals; from the known to the unknown. So that, before attempting to investigate the conditions of the past, something should be known about those of the present. He who would argue about the substance of the moon without knowing something of the composition of the earth, would not deserve the confidence nor merit the hearing of his fellows. So he who would argue about the formation of rocks, without a knowledge of the manner of the deposition of sediment at the present day, should meet a similar fate.

It has been generally acknowledged by geologists, at least by those of the uniformitarian school, that the changes on the earth's surface have been gradual. All the introductions and extinctions of animal forms have come slowly. Rivers have carved their beds, and mountains have been elevated by slight degrees. The majority of changes, however vast, have been produced by such agents as are at present modifying the surface of the earth.

These agents and their effects being the same, it is possible, by studying what is going on in the present age, to picture what went on in past ages. Rain fell as it falls on the earth and washed it away. Water held the sediment and deposited it in the same way then that it does now. Rivers rose and fell. Tides ebbed and flowed. Their effects were the same. Sediment was left on the retiring of the waters of rivers, and on the ebbing of the tide. So that as far as the aqueous forces are concerned, their effects may be regarded the same ten million years ago as they were only ten years ago.

But while the physical agents were unchanged, and their effects were as they still are, the forms of life have undergone a complete and entire revolution. Not a single creature is identical with its forerunners of the Silurian and Carboniferous epochs. Yet, though neither the species nor the genera are identical or hardly similar, the general types are much the same. Corals, echinoderms, lamellibranchs, gasteropods, annelids, crustaceans, all frequented the Palæozoic seas. All of them have left their remains in the rocks in abundance; sometimes so plainly, that there can be no doubt as to their character; at other times so imperfectly, as to be difficult of determination. And while many students have observed these remains, the observations have not been made as they might have been. The idea seems to have been that every mark was made by a living thing, or was the remains of a species. Sufficient attention does not seem to have been paid to the varying conditions of life, nor to the natural forces then active. It is the object of the present paper to call attention to, and show the true character of, certain marks found in the rocks of the Cincinnati group which have previously been regarded as organic.

CHARACTER OF FUCOIDS.

The term "fucoid" is one which has been used by palæontologists in the most indefinite way. It has been applied to all sorts of markings, and, like charity, covers a multitude of sins. Almost every obscure or undeterminable form has been called a "fucoid," or has been said to be made up of "fucoidal matter." Abused as the word has been. it has come at last to have none of its original significance, and should either be restricted to what are strictly remains of seaweeds, as the term implies, or else discarded altogether. The latter would, perhaps, be the better course, and the word Algæ substituted in its place. But, at the same time, care should be taken that none but what are the remains of Algæ should be referred to the class.

As this order of plants is known now, there are few, indeed, of them that

are likely to be preserved as fossils.* Consisting, as they do, of thin cellular, membraneous tissue, sometimes with a central rib, sometimes lacking it; with or without a stem; sometimes coarse and sometimes formed of delicate thread-like fibers, there are comparatively few which seem to be capable of preservation. There is no reason to suppose that the ancient progenitors of the Algæ were more likely to be preserved than are the modern prototypes; and it should be considered rather a matter of surprise to find any in a fossil state, than a thing to be expected. The fact is, that the majority of the remains which have been called "fucoids," and thus referred to the Algæ, are not plants at all, and are in some cases not even of an organic nature. When such is the case, and when mud marks, annelid trails, burrows, trails of gasteropods and lamellibranchs, and casts of articulate tracks have been called fucoids, it is time to investigate the state of affairs, and endeavor to settle the disputed question as to what shall be called Algæ and what not.

There can be no possible objection to describing and figuring the trails, tracks or burrows of animals which lived in long past ages as long as they are considered *as* trails or burrows. But there is considerable objection to calling them and referring to them as Algæ, when they have no connection whatever with plants. The rocks of the Cincinnati group and the Clinton group are full of markings of various sorts, much more so in fact than the higher formations. As they are generally of an obscure and indefinite character, they have been either largely overlooked, or else studied in a careless and superficial manner. For while corals, crinoids, mollusks and crustaceans have been carefully studied, the large field occupied by the above-mentioned markings has been disregarded. Yet they are at the same time valuable as showing one very important thing, and that is, that the conditions of nature were the same, or very similar, to those we find at present.

* NOTE.—In regard to the preservation of Algæ in modern times, Lesquereux, in the Thirteenth Annual Report of the State Geologist of Indiana, 1883, Part II., p. 26, says: "When rapidly decomposed under atmospheric influences, the marine plants pass to a fluid state, or when coriaceous, they are dissolved under the alternate action of dryness and humidity. The heaps of wrack, or of hard species of marine Algæ thrown upon the beach by the waves, do not become compact and dry, and can never be used for fuel, like peat; they gradually pass at the base of the banks into a half-fluid matter, which percolates through the sand." Now it is a peculiarity of the remains which have been referred to "fucoids," that they are found on what were sea-beaches, where they would be exposed to the "alternate action of dryness and humidity," and, therefore, be little likely to be preserved. The assertion that they were exposed on sea-beaches will be referred to later on and proved.

MODERN MUD MARKINGS.

As preliminary to a consideration of these fossil marks, it will be necessary to study some of the markings found on the mud banks of rivers, or on ocean beaches when the tide has ebbed. The tracks or marks produced by animal forms will naturally be different now from what they were during the Silurian age. But those produced by natural causes simply, as, for instance, the action of rain or the water of rivers on mud, or by the daily ebb and flow of the tide, may be considered as at least similar, both then and now.

Some of these marks have been observed on sea beaches by Sir Charles Lyell. In his "Prin. of Geol." (Vol. I., p. 327), he remarks, in reference to impressions of rain-drops on the mud flats of the Bay of Fundy, as follows: "When a shower of rain falls, the highest portion of the mud-covered flat is usually too hard to receive any impressions; while that recently uncovered by the tide near the water's edge is too soft. Between these areas a zone occurs almost as smooth and even as a looking-glass, on which every drop forms a cavity of circular or oval form; and if the shower be transient, these pits retain their shape permanently, being dried by the sun, and being then too firm to be effaced by the action of the succeeding tide, which deposits on them a new layer of mud. Hence we find on splitting open a slab an inch or more thick, on the upper surface of which marks of rain occur, that an inferior layer, deposited perhaps ten or twelve tides previously, exhibits on its under surface perfect casts of rain prints which stand out in relief, the molds of the same being seen in the layer below."

Precisely the same thing can be seen on the muddy banks of rivers after a flood, and when a shower of rain falls before the mud is entirely dry. My own observations show that the impressions are large, circular and distinct. (Plate V., figure 1.) If the shower was only a light one, the impressions remain distinct and separated. But if heavy, they are more or less irregular; and in the case of very heavy rains they become entirely obliterated, and the surface is marked with many rills along which the water has run; and on a gentle slope a larger channel will carry off the water to the main stream, or into some depression. On quite soft mud, close to the edge of the stream, the impressions are never so distinct. The same impressions and casts referred to by Lyell, I have seen on splitting open slabs of mud which had dried on the shore.

FOSSIL MUD-MARKINGS.

If such are the effects of rain on modern mud banks, the inference is just that if similar markings are found in the rocks, they were produced by similar causes. Like causes produce like effects; so that, as specimens of rock have been found containing impressions like these rain-drops, it may be considered that they were made in the same way. Dr. Dawson, in "Acadian Geology," p. 27, figures rocks from the Carboniferous with rain-drop impressions. Lyell, in "Travels in America" (first visit), Vol. II., p. 140, refers to similar ones from the red sandstone of New Jersey; and quite recently Mr. U. P. James has found in Clinton County, Ohio, in strata of the Cincinnati group, exactly similar markings, as shown in Plate V., figure 2.

The inferences from these facts are evident. The marks could have been made in no other way than on mud beaches alternately bared and covered by the tide. And if this is the case, it becomes proof positive that part of the strata, at least, was deposited in shallow water or on the margin of the ocean. It has been thought that the strata of this group were deposited in deep water, but facts are known now which are sufficient to prove the reverse. Some of these will be given presently.

CLASSIFICATION OF THE FUCOIDS.

The fossils which have been referred to fucoids may be classified under three different heads: 1. Mud marks, concretions or rain marks; 2. Tracks or trails of annelids, mollusks or crustaceans; 3. Probable Algæ. Of these, the last are the least and the second are the most numerous. Taking them in order, mud marks, and so on, come first under consideration.

FUCOIDAL MUD MARKS.

Next to the rain-drops on mud flats or banks come mud bubbles. These are often seen—sometimes perfectly circular, one-half to three-quarters of an inch in diameter, and are of liquid mud, strong enough to stand considerable pressure without bursting. (Plate V., figure 3.) These are represented in the rocks of the Cincinnati group by a form which has been described as a fucoid under the name of *Discophycus typicalis*, Walcott, "Trans. Alb. Inst.," Vol. X., p. 19; (Plate V., figure 4.) This is described as being almost circular, flat, and with a corrugated or furrowed edge, as if a rather succulent material had been wrinkled under pressure. In the strata of the Utica slate, sometimes considered as Cincinnati group, another form was described by Walcott (in "Trans. Alb. Inst.," Vol. X., p. 19) as *Cyathophycus subsphericus*. (Plate V., figure 5.) The apex of this has

sometimes been found burst, and the edges of the aperture torn irregularly. It seems most likely that these so-called fucoids are, in reality, fossilized mud bubbles. All appearances indicate it; and, if so, they can scarcely be considered worthy of generic and specific names. It seems wiser to altogether discard these species and look upon them as ancient relics of gaseous formation of the Silurian age.

Another sort of a mud mark which has been called a fucoid, is sometimes found covering large slabs with long, straight lines, occasionally bulging out in certain spots. Examining the recent mud flats, precisely similar appearances are seen. (Plate V., figure 6.) They are caused often by a small stick or stone, or even the body of an insect lodging on the mud, and causing the current to break and flow to each side and depositing a streak of mud behind it. Some of these specimens have been referred to *Scolithus linearis* (Hall), but erroneously; for this species of Hall's comes under the second head, that of burrows, and it has probably not been found in the Cincinnati group.

Still another sort of mud mark has been formed in a curious way. Along the edges of streams, on the retiring of the waters of a flood, there are often little shallow pools filled with muddy water. The edges of these pools, as they dry, assume irregular shapes, and the mud is often deposited in such a manner as to retain this shape. (Plate V., figure 7.) Sometimes it forms an irregular semi-circle, and as the mud in the depression is of a lighter color than that outside, it becomes quite conspicuous. A figure (Plate V., figure 8) is given in "Pal. of New York," Vol. II., Plate 11, very like the one here shown; and Prof. Hall said of the one he figured, that though it had different features than ordinary wave lines, it might be due to inorganic causes. A still more remarkable one, and quite as certainly a mud splash, is in the collection of this Society, and was found near Covington, Ky. It is here shown (Plate V., figure 9) to compare with the mark of known origin, and comparison is all that is necessary to note the resemblance.

The washing of water against the bank of a stream often produces ripple marks which extend along the shores for some distance in regular, undulating lines. One layer deposited on another to a thickness of several inches gives an appearance like stratification; and, as similar appearances are presented in some of the rocks of this vicinity, they have been described as organic under the name of *Palæophycus flexuous* (James). (Plate VI., figure 1.) On calling the attention of the describer of the fossil to the recent marks, he at once admitted their similarity, and acquiesced in the suggestion that their origin in each case was the same.

The heavy dashing of rain on the surface of mud will often make irregularly arranged elevations and depressions, with often a little channel leading the superfluous water to a lower level. This washing will frequently give the surface of the soil an appearance very remotely resembling the branches of a plant, and the cast will often be more misleading than the marks themselves. Pieces of mud found in a fossil state having such markings on them, have led to the establishment of a genus of so-called fucoids under the năme of *Aristophycus*. It was first described and figured by Miller and Dyer, in No. 2 of "Contri. to Pal." (pp. 3, 4). One species, *A. ramosum* (Plate VI., figure 2), and a variety, *germanum*. were described. The species is described as consisting of a stem which divides and subdivides in an irregular manner. "The ramifications are sent off," say the authors, "like the roots of a tree or shrub, without any determinate order, while many of the smaller fibers inosculate like the veins in the leaf of a tree." The variety differs from the species in having more numerous and smaller branches. Neither one can be considered as entitled to a name of any kind. There are no characters upon which to base the assertion that it was a plant, and every indication that it was made by rain on the surface of mud as before intimăted. The same features may be seen on any muddy surface after a moderately heavy rain.

On other places of a mud flat, other indications of the action of water are to be seen. On gently sloping banks small lateral rivulets will be seen running into large ones, and these large ones into others still larger. The smallest and the branch into which they run often assume a feather-like form, the main channel representing the shaft and the small lateral ones the web of the feather.

From rocks of the Cincinnati group there has been described a genus with the name of *Chloephycus*. It was established by Miller and Dyer, in "Contri. to Pal.," No. 2 (p. 3), and one species (*C. plumosum*) was figured and described. (Plate VI., figure 3.) The figure and the description, and the specimens themselves, indicate the character of the fossil. It is nothing more than a mark, or a series of marks, produced in the way already described by the running of water down a sloping bank into a stream.

If these channels, with their lateral branchlets in the mud, were enlarged, a deeper channel would result. If a cast were then taken from the depression, it would be rounded on one side and flat on the other. The rounded side would be marked with lines running from the center toward the edge, or overlapping irregularly along it. Now, the genus *Trichophycus* was founded by Miller and Dyer, in "Contri. to Pal.," No. 1

(JOUR. CIN. SOC. NAT. HIST, Vol. I., p. 24), and made to include certain "fucoids" having cylindrical stems with diagonal or longitudinal markings, as if hair-like filaments had been pressed down flat on the stem. The *T. venosum* was described by S. A. Miller, in JOUR. CIN. SOC. NAT. HIST., Vol. II., p. 112, and there figured. Dawson, in "Acadian Geology" (p. 27), figures a specimen of what he calls "rill-marks" (Plate VI., figure 4) from the Carboniferous, formed in some such way as can be seen on mud banks now, and *Trichophycus venosum* is evidently of similar origin. The describer of it says that the plant "consists of a half-cylindrical stem, covered on the cylindrical surface with irregular and inconstant elevated lines," which vary from longitudinal to "diagonally radiating from a central line." The description of the fossil corresponds so very well with the recent mud mark, that there can scarcely be a doubt as to their having been made in the same way. Another species of the same genus—*T. sulcatum* (Plate VI., figure 5)—was described by M. and D., in "Contri. to Pal.," No. 2 (p. 4). This is also a fossil rill-mark. For while the surface is longitudinally furrowed, these "furrows are not regular in their size, nor in their course. Sometimes the larger ones are running parallel to each other; at other times several smaller ones intervene." In fact, both figure and description indicate that here again is a fossil with a name which it does not deserve, and which is without question a mark of inorganic character.

As long ago as 1852, Prof. James Hall figured in "Pal. of New York," Vol. II., some fossil remains which he considered as roots or parts of marine plants. Among them (on Plate XI.) is a figure of a peculiar dumb-bell fossil. (Plate VI., figure 6*a*.) This he did not venture to name; but in 1874 Dr. Billings, in "Pal. Foss. of Canada," Vol. II., figured a similar form which he called *Arthraria antiquata* (Plate VI., figure 6*b*), coining the new genus for the reception of the one species. There is no mistaking the form in its resemblance to that of Prof. Hall's, and there can be no question but that they are both the same. In 1875, in *Cin. Quar. Jour. Science*, Vol. II., p. 354, Mr. S. A. Miller described a species of *Arthraria* under the name of *A. biclavata*. His figure shows perfectly round balls at the ends of a wonderfully symmetrical stem, such as would hardly be found. Still, a great variation is to be detected in the shape and size of different specimens. Some are round, some square, some rough at the ends. (Plate VI., figure 6*c*.) In many cases all that remains of them is a depression in the rock, the whole substance having been dissolved. Were species to be distinguished on the form alone, every

specimen would be a different species. It is therefore better, if it be considered a species at all, to regard all the forms as one.

As none of these three figures—Hall's, Billings' or Miller's - show any signs of structure, and as neither Billings' nor Miller's descriptions give any indication that the fossil possessed any, it is difficult to say why it should be considered as an Alga, or, in fact, an organism of any sort. As the differences between Billings' and Miller's descriptions are immaterial, there can be no doubt but that the *A. biclavata* is a synonym of *A. antiquata*, and should be so regarded. There being no structure exhibited, and though the form is constant, yet it seems more probable that it is a concretion than that it is organic. This is here thrown out as a suggestion.

These, then, may be regarded as the products of the action of water upon mud, and the result is that eight so-called species and one variety disappear altogether. These species are: Aristophycus ramosum, M. & D.; Var. germanum, M. & D.; Arthraria antiquata, Billings; (A. biclavata, S. A. M.); Discophycus typicalis, Walcott; Cyathophycus subsphericus, Walcott; Palæophycus flexuosus, James; Trichophycus venosum, S. A. M.; Trichophycus sulcatum, M. & D.; Chloephycus plumosum, M. & D.

[TO BE CONCLUDED.]

THE VILLAGE INDIANS OF NEW MEXICO.

BY JAMES W. ABERT.

Read before the Society, September, 1884.

These interesting people have always awakened great thought and study in the minds of ethnologists, on account of their attainments in civilization as well as the intimate relations they seem to bear to that mysterious pre-historic race whom we designate as the Mound Builders.

From the days of Francisco Coronado, these Pueblo Indians have been noted for their peculiar characteristics, so different from other tribes of Indians. They are sober, industrious and conspicuous for morality and honesty. Cannibalism and human sacrifice were nowhere found among them.

When I visited New Mexico in 1847, there were twenty Pueblo villages still inhabited, numbers depopulated and in ruins, and many, of which the Indian population had been supplanted by the Spanish race.

The whole population of the Pueblos, as given by the U. S. Census, is

7,867. The population of these villages never could have been very large, for the agricultural land in their vicinity could never have furnished means of subsistence for a much larger population in each town.

Their habits have been much modified by intercourse with the Spanish and American races. In early times they used to dress in garments made of the black seed-cotton, which is indigenous—now they dress chiefly in woolen garments of their own weaving.

In this paper I purpose to speak chiefly of their architecture. Many of its characteristic features are peculiar to the structures of all semi-civilized people.

Their buildings have flat roofs, small windows, originally no fireplaces, no openings or doors on the ground floor, ladders to ascend to the second story, communal houses, buildings on the rectangular system, open court-yards, houses on three sides closed in by a wall on the fourth side, towns oriented, "corrals," or circular inclosures near the town for sheltering cattle and sheep.

These corrals, in the days of the "conquistadores," were used to contain tame buffalo, deer and antelope—which with poultry, consisting of tamed turkeys, partridges and ducks, formed a good part of the subsistence of the Pueblos.

Their houses are generally but three stories high—three rooms deep on the first floor, two on the second and one on the third floor—so that the cross-section presented the form of a flight of three steps.

The Pueblo of Taos (Ancient Braba) contained houses five stories high. A small creek divided the town, but the houses were connected by a bridge.

Of their ruined towns, Hungo Pavie was 300 feet by 144 feet. It contained 144 rooms about 12 feet square, with estufas for religious ceremonies, and possessed a population of 800 souls.

The Pueblo Bonito contained 641 rooms.

Castenada, who accompanied the expedition of Francisco Coronado to New Mexico in 1540–42, estimated the population of the fourteen villages of Cibola and Tucayan at four thousand men, probably warriors, and that of the numerous villages on and near the Rio Grande and its tributaries at sixteen thousand souls.

In the works of Bernal Diez you will find a drawing of a Temple of Mexico, which possesses all the characteristic features of the dwellings of the Pueblo Indians.

The Temple of Mexico, at Cholula, was four stories high; the Temple of the Sun 221 feet high; the Temple of the Moon 144 feet high. They

were built of sun-dried brick, faced with stone and covered with hard cement. The lesser pyramid contained a passage-way which descends at an angle of 30°. In this respect it resembled the great Pyramid of Cheops.

One of the most interesting villages that I visited is called Acoma. It is situated on the headwaters of a stream which empties into the Rio del Norte, and was first described by Nunez Cabeça de Vaca in 1536.

Acoma is located upon the top of a high, flat rock, whose sides rise vertically out of the surrounding plain to the height of 300 feet.

The top of the rock embraces an area of ten acres. Here you find a tank for water, which is 150 feet by 20 feet and 5 feet in depth.

The population of Acoma is 350. It is 80 miles east of Zuñi and 50 miles west of the Rio Grande. The houses are built of adobes. As you go further south you find the Pueblos begin to use rough stone; and the Indians of Mexico and Yucatan used dressed stone.

Wooden lintels were used for door and windows, and over some small windows are found stone lintels of 18 inches in length.

Mr. Albert Gallatin believed that the civilization of New Mexico was derived from the South. He says "The agriculture of New Mexico did not originate here and was not thence transferred northwardly; the very reverse is the case." Again he says: "The civilization of the Gila and New Mexico was not of native growth; it appears most certain that it could not have been introduced from either the east, north or west. In either of these directions those people were surrounded by wild nations, in the hunter state, and cultivated nothing." As we all know, both the maize and the cotton belong to semi-tropicalregions.

We would now attempt to classify the different styles of architecture possessed by the indigenous races of North America.

1. The square, hewn stone structures of the people of Yucatan, the City of Mexico and the neighboring regions.

2. The square, adobe communal buildings of the Pueblo Indians of New Mexico, Colorado and Arizona.

3. The round. mound-shaped dirt dwellings of the Mandans and Minitarees.

4. The birch-bark wigwams of the Winnebagoes and Chippewas.

5. The conical tent dwellings of the nomadic tribes.

6. The rude shelters of accidentally occurring materials, such as are used by the Digger Indians.

1. The most civilized of our North American races were ignorant of the groined arch, the cylindrical arch, and of the simple circular arch for

doorways and windows. The buildings found in Mexico by Cortez consisted of "teocalli" temples erected on mounds, each story narrower than the one immediately beneath it, so that they seemed to recede as you ascend, like steps of a stairway.

Dressed stone was used in constructing their buildings. They possessed hard copper tools capable of cutting the hardest stone, and the carving of their idols and of such stones as the great Calendar Stone of the City of Mexico demonstrates their skill in handling the stone-cutter's chisel.

The pointed arch is seen in the "House of the Nuns," at Uxmal. In this kind of arch a core was first filled up solid, and this material was afterward removed when the cement had hardened. This pointed arch was noticed in New Mexico by Genl. J. H. Simpson, U. S. Army.

2. The Indians of our Pueblos build their houses three or four stories high of "adobes;" they are communal houses placed so as to surround an open court-yard or "plaza;" each story recedes the width of one room, and has a low parapet wall for defense along the upper edge of the first story. The exterior face or wall of these blocks of houses presents a single vertical face, and no openings near to the ground. There are no doors to the first story, so that one is forced to ascend to the second floor by the means of ladders in order to gain admittance. In time of attack by an enemy the ladders are drawn up, which would render the town inaccessible to any Indian force.

The division walls between adjacent houses are oftentimes sloped at an angle of 45 degrees and cut into steps, so the inhabitants may ascend to the highest of their flat roofs, which are used for drying meats, fruits and vegetables, also for sleeping places in warm weather.

3. The Mandan dwellings are large communal houses of circular form, the foundations sunken from two to three feet in the ground. The interior is from 40 to 50 feet in diameter; four large posts about 15 feet high stand near the center to support cross pieces, upon which the rafters are laid; the posts of the walls of the circumference, twelve in number, are about five feet in height; a circular opening is left in the center of the roof for the exit of smoke; a square door gives access to the dwelling. The whole structure is covered, both sides and roof, with from two to three feet of earth.

Dr. F. W. Langdon tells me that many ruins of such structures are found along the Miami River, and Catlin has traced the Mandans by their ruined houses down the Ohio to Cairo, and up the Mississippi and Missouri Rivers to the mouth of the Yellowstone River.

4. The framework wigwams, such as are constructed by the Winne-

bagoes and Chippewas. They are made by forming a skeleton structure of saplings, which constitute a rectangular framework with a cylindrical roof, and the whole is covered with sheets of birch bark, tied fast to the saplings with withes of bark. Close around the foot of the interior walls are raised platforms about six feet wide and six inches high—upon these the inmates sleep. The Indian mothers have posts driven in the ground, to which are swung hammocks for their babies. Fires for warmth and for cooking are built near the center of the room, and a hole in the roof allows the exit of the smoke.

5. The conical tent dwellings of our nomadic Indians are formed of lodge poles—their smaller ends meeting together for the vertex of the cone. Their but-ends are arranged on a circle of from 10 to 15 feet diameter. The exterior is covered with skins of wild animals, from which the hair has been removed.

The door is changed to the leeward, so as to avoid the cold winds and driving rain or snow. A chimney-hole is left at the top. The fire, with a tripod to hold the meat pot, is located in the center.

Some lodges, as among the Comanches, are thatched with wild grass.

6. Indians, such as our Digger Indians, and war parties, use whatever they find available for the purpose of shelter; old roots and limbs of trees are twisted together, forming a dome-shaped structure. Caves are scooped out of bluff clay banks.

The Indians of New Mexico frequently erect circular walls of rough stone, which are sometimes covered with boughs, or logs or skins; here the wily savages can lurk and watch for their enemies, spying from between the stones, which to the passer-by look like a simple pile of rough rocks.

The Mound Builders, in regard to their architectural attainments, I would place between the Pueblo Indian who builds his three-story houses of adobes, and the Mandan Indian who builds his circular, mound-like dwelling of wooden posts with clay-covered roof.

As regards the vast mounds erected by the Mound Builders, they were superior in the grandeur of their monumental structures to either the Pueblo Indian or the Mandan, as is shown by the great mound at Cahokio, Ill., which contains twenty million cubic feet of earth.

Whether I am right or wrong in my conjectures, I hope, at all events, that this attempt to classify the works of our Indians may awaken interest and inquiry in the minds of others, who may be induced to carry out the needful investigations in regard to the ethnology and archæology of the Pueblo Indians.

DESCRIPTIONS OF FOUR NEW SPECIES OF FOSSILS FROM THE CINCINNATI GROUP.

BY U. P. JAMES.

(Read June 3, 1884.)

GENUS MONTICULIPORA, D'ORBIGNY.

MONTICULIPORA OHIOENSIS, Sp. nov.

(Plate VII., figures 1 and 1a.)

THE numerous fragments found of the corallum of this species vary greatly in size and particular outline. The stems and branches are mostly cylindrical or sub-cylindrical, but sometimes slightly flattened, especially at places of branching. The branches are frequent and irregular, both as to distance apart and angle, but generally dichotomous. Some specimens (rarely) have a tumid form. (See figure 1a.) The surface is occupied by numerous conspicuous, elevated, rounded monticules, arranged in a somewhat alternate manner, averaging about one-twentieth of an inch in diameter at the base, and a little over or the same distance apart. The surface shows two series of tubes, with tolerably thick walls at the apertures; the larger are circular or sub-polygonal, with eight to ten calices in the space of one-tenth of an inch; the smaller, which are numerous, are round or angular. The calices on the monticules do not vary in size or shape from those occupying the general surface. The size of specimens vary from about three-twentieths of an inch in diameter to twelve-twentieths, and in some cases across the flattened portions at points of branching over one and one-fourth inches. (See figure 1.)

Longitudinal sections cut through the center of the stems show the tubes as having but a slight outward inclination in the axial region, but they soon curve abruptly at right angles and take a direct course to the surface; the walls of the tubes are thin and wavy in the center, but become decidedly thickened, and, apparently, somewhat fused together immediately outside of the sharp curve. The tabulæ in the axial portion are few or wholly wanting; but after the tubes curve and approach the surface the tabulæ become numerous, passing directly across the tubes, from wall to wall; the small interstitial tubes are no more closely tabulate than the larger, as far as observed. A transverse section shows the ends of the tubes, in the axial region, as thin-walled and polygonal in shape; but outside of the abrupt curve the tube walls are seen to be thickened, in long section. A tangential section shows the larger tubes to be irreg-

ularly rounded, and the smaller "interstitial" ones of various shapes, and a few of what may be "spiniform corallites" or hollow tubuli.

In the feature of the numerous interstitial tubes, and thickened walls of the outer portion of the corallites, as seen in long section, and the appearance of the tangential section, this species resembles M. *ulrichi* Nichn, but in all other features it is materially different, especially in the prominent, conspicuous *monticules*, and tabulation of the two sets of corallites. Prof. N. says, in regard to M. *ulrichi*: "*The surface is smooth and destitute of monticules*," and that the interstitial tubes are "*much more closely tabulate*" than the larger corallites, which is not the case in M. *ohioensis*. Another decided difference, not so important perhaps, is the much more robust habit and larger size of specimens of *ohioensis* than *ulrichi*.

Position and locality: Cincinnati Group: Upper side of Columbia Avenue, Cincinnati, about 200 feet above low water mark of the Ohio River. It may be found at other localities—probably is—but this is the one where the writer found the type forms, and many variable duplicates.

MONTICULIPORA FALESI, Sp. nov.
(Plate VII., figures 2 to 2d.)

The corallum of this species varies in outline from an oval base and low, convex upper surface to a round base and steep, conical slopes to a small, circular apex. (See figures 2 to 2d) The specimens with low and moderately elevated convex upper surface seem to be young individuals. (Figures 2a to 2d.) The base margins are quite thin and sharp. The surface is occupied by circular and polygonal calices and stellate maculæ. The maculæ are irregularly distributed over the surface, and very little —some not at all—raised above the general surface. Walls of tubes thin at the aperatures. There are about seven or eight calices to one-tenth of an inch between the maculæ, but on the maculæ they are considerably larger. In some cases, the maculæ seem to be sub-solid in the center; others have a larger calyx occupying that position. A few interstitial tubes noticed, and a small number of "spiniform corallites."

On the under part of the base of the coral is a regularly outlined conical groove extending nearly across the middle of the longest diameter, to a pointed apex; the concave surface of the groove is covered with very delicate, crowded, transverse striæ (see figure 2a); this feature (the conical groove) is constant in all of seven examples examined. A delicate epitheca probably covered the entire base, but has, apparently, been weathered away. The conical groove seems to be altogether normal, and is a marked feature of the species.

A vertical section taken from one of the larger conical specimens, near the base margin, shows thin-walled corallites as taking a direct course from the base to the upper, outer surface. The tabulæ are clearly defined and closely set throughout. In some cases, the tubes show a series of vesicles attached to one side of the tube and extending only half-way across; direct tabulæ attached to the other side and occupying the other half. In a tangential section the tubes appear circular; and close to one side of each (inside) is a minute opening, then a dark, curved line from wall to wall enclosing the small opening, and shading off to the opposite side of the interior of the tube, giving the inner space a decided crescentic appearance. Prof. Nicholson, in referring to a similar feature of a different species, says it (the crescentic feature) "is due to the intersection of the peculiar vesicular tabulæ on one side of the tube."

The writer is indebted to Prof. J. C. Fales, of Center College, Danville, Kentucky, for the specimens used in this description. Prof. F. writes: "They seem to be quite numerous and in various localities below the Orthis lynx bed;" which indicates about the horizon of the tops of hills at Cincinnati, Ohio.

The name is given in honor of Prof. Fales.

GENUS STROMATOPORA, De Blainville.

Stromatopora tubularis, Sp. nov.

(Plate VII., figures 3-3b.)

This fossil is circular in outline transversely, and cylindrical longitudinally; composed of a succession of irregular laminæ about one-twentieth of an inch, each, in thickness, making up a total of from one-fourth to one-half an inch. Hollow inside (see figure 3). Cut transversely, the laminæ are shown as wavy, concentric lines of growth, with thin interspaces and serrate-like edges. Irregularly distributed throughout are small circular spots with dark centers and canal-like grooves, crossing the laminæ at different angles. Different specimens, used for this description, vary in *diameter* from two to two and one-half inches, and in *length* about one inch.

The tubular portions are all in part or wholly filled with other substances, broken corals and shells, or clay. The surface markings of all specimens so far examined are quite unsatisfactory, being overgrown, apparently, with some species of Polyzoan, and much weathered and abraded.

Magnified sections taken from the figured, type, specimen are shown in figure 3a transverse, and 3b longitudinal, across the vertical edges of the laminæ.

Found in the Cincinnati group at different localities and horizons at and near Cincinnati, Ohio.

STROMATOPORA LUDLOWENSIS, Sp. nov.

(Plate VII., figures 4 and 4*a*.)

This fossil is composed of irregular, undulating, concentric laminæ of variable thickness, from four to six in the space of one-tenth of an inch, including interspaces. Is of various amorphous outlines and sizes; sometimes built upon and around other substances. One specimen is 4½x3 inches in the longest and widest direction, and about two and one-half inches thick; grown upon Monticulipora mammulata (?), covering the coral nearly entire to the variable thickness of from one-tenth to over three-tenths of an inch. The specimen figured is not built upon any foreign substance, but is made up altogether of the concentric laminæ.

A polished transverse section (see figure 4*a*) shows the superimposed laminæ and a number of circular and oval pits, seemingly transversely cut-off oscula, irregularly distributed through the fossil; and a convex portion of the same specimen cut obliquely, at a low angle, through the laminæ, shows several of the canals traversing the mass in different directions. The surface of all specimens examined is irregular and rough, showing numerous minute pores and more or less of the larger—oscula—openings.

The type (figure 4) specimen and others used for this description, were found by the writer near Ludlow, Kentucky, opposite the lower part of Cincinnati, about fifty or sixty feet above low-water mark of the Ohio River. Cincinnati group. Others found on the hills of Cincinnati and elsewhere at higher horizons.

BLACK AND OSWEGO BASS.

BY CHAS. DURY.

Read and referred, August 5, 1884.

Dr. HENSHALL says in Appendix No. 1, of the eighth Annual Report of the Ohio Fish Commission: "Possibly no genus of fishes has been the occasion of so much confusion, scientifically and popularly speaking, as the Black Bass." Although Dr. Henshall is the highest authority on this subject, and gives very exactly the differences between the true "Black Bass," *Micropterus dolomieu*, and the "Oswego Bass," *Micropterus nigricans*, and although the extreme of *dolomieu* and the extreme of *nigricans* are very different, yet the intermediate forms are impossible to locate.

The differences given by Dr. H. are that the "Oswego Bass" has a much larger mouth than the true Black Bass. Hence he calls it the "Large Mouthed Bass," and the other the "Small Mouthed Bass." The

Large Mouth Bass has much larger scales than the other species, and the dorsal fin has the spinous rays lower and with a deeper notch than in the Small Mouthed species. Color is of no value whatever as a character, as the surroundings seem to determine this in a great measure, and both forms occur of all shades from black to white, but principally of different shades of green and olive.

The "Black Bass," in different sections of the country, has the following popular names:

Bass, Black Bass, Green Bass, Yellow Bass, River Bass, Bayou Bass, Slough Bass, Lake Bass, Moss Bass, Grass Bass, Marsh Bass, Oswego Bass, Perch, Black Perch, Yellow Perch, Trout Perch, Jumping Perch, Welshman, Trout, Black Trout, White Trout, Roanoke Chub, etc. The "Large Mouth Bass" seems to me grows larger than the "Small Mouthed" species. I have caught a Large Mouthed Bass in St. Mary's Reservoir, that weighed 7 lbs. and 14 oz.

I saw the head of one at Enterprise, Florida, that weighed 14 lbs. The largest specimen of the Small Mouthed form I ever saw, is the one exhibited, which was caught by a member of the Cuvier Club, and it weighed about 6 lbs., I think a trifle less. I have heard of specimens that weighed over 7 lbs., but never saw one. A fish nearly always weighs more on the scales of the person who catches it, than elsewhere. The greatest size attained by the Small Mouthed species has been a matter of much controversy. A very amusing incident occurred some time ago, when some wag sent a communication to a Pennsylvania paper, in which it was stated that the "Cuvier Club," of Cincinnati, Ohio, would give $100 in gold, reward for a "Black Bass" that weighed as much as 7 lbs. This was copied by papers all over the United States, and many disciples of Izaak Walton sailed in to capture a seven-pound Bass and the $100 reward. I was acting Corresponding Secretary of the Club at the time, and was tormented nearly to death answering communications. Some were of inquiry, and some claimed the reward and had numerous affidavits, duly sworn to before Magistrates, to substantiate their claims. One was a poor man and this $100 would do him a heap of good. Two others gave minute directions how to remit the money, on the strength of their sworn statement of a fish they once caught that would weigh over 7 lbs. I let them all down as easily as possible in my replies. I got partly paid for my trouble in eating the fine fish sent as proof positive to secure them this reward. The specimen stuffed is one of these. It was caught by Wm. Dormire and Chas Burrock. This is the letter that came with the fish.

WARSAW, IND., *March* 14, 1884.

OFFICERS AND MEMBERS OF CUVIER CLUB,
Cincinnati, Ohio.

Gentlemen:

We ship you per express this evening a Black Bass, caught by us with hook and line on Pike Lake, Kosciusko County, Indiana, one half mile from Warsaw, the county-seat, which weighs on three several scales 7¼ lbs.

We send the fish (packed in ice) to compete for premium of $100 offered by your Club for a Black Bass caught with hook and line, weighing 7 lbs.

Yours truly,
WILLIAM DORMIRE.
CHARLES BURROCK.

I replied to these gentlemen that the fish had been received, and I had stuffed its skin for the Club's Museum, and for so fine a specimen the Club sent thanks, and I had eaten the meat and felt better afterward, though I thought smaller fish were rather better than such large ones. I also stated that the Club had not offered a reward for the destruction of "Black Bass," and that the object of the Club was to increase rather than diminish the supply of food-fishes. Though I don't think it would be safe for me to go to Warsaw, Ind., yet I have not heard from the gentlemen since. I have often thought that the "Oswego Bass" was only a race produced by its surroundings. I never saw this form from the swift, flowing waters of our rivers, nor the Small Mouthed Bass from the still, dead water of the reservoirs. Some years ago, a pond in Avondale was stocked with some Small Mouthed Black Bass from Lake Erie. After a few years the owner of the pond moved away, and his successor did not care much about fish; so I went fishing in the pond, and all the fish caught were the Large Mouthed or Oswego Bass. Several years ago, Ross Lake, near Carthage, was stocked with genuine Small Mouthed Black Bass from Lake Erie, and now not a single specimen of the "Small Mouthed Bass" has been taken there, that I can hear of; all are the Large Mouthed or Oswego Bass. Mr. Wm. Hall, who is an excellent judge in such matters, and who has caught a number of specimens from Ross Lake, says they are all "Oswego Bass." I have heard of several isolated waters being stocked with "Black Bass," and after a few years, when the fish reproduced and were captured, all proved typical "Oswego Bass." This, though negative, is very strong evidence that the Oswego is merely a still-water race of the "Small Mouthed" species.

Dr. Henshall considers these Bass the most gamey fish living. Their voracity is astonishing. I have had the small three-inch specimens confined in my aquariums swallow minnows so long they were obliged to swim about for nearly an hour with the victim's tail protruding from their mouths, not being able to swallow the entire fish for want of capacity, and the head had to be digested before the tail portion could all be taken in.

Bass confined in a tank will never live peaceably together, but fight; or rather the larger ones drive the smaller ones, until they either kill them or make them jump out of the tank.

The spawn of Black Bass can not be hatched successfully by artificial means, as can the spawn of "White Fish" and "Pike Perch;" but to obtain young fish for restocking depleted waters, the fry must be obtained by netting them, a very difficult and laborious task. The small Bass furnished by the State Fish Commission to the Cuvier Club for distribution in the waters hereabout, cost the State $5.00 per one hundred fish.

ON CONODONTS AND FOSSIL ANNELID JAWS.

By U. P. James.

Read August 5, 1884.

Though of great interest to Paleontologists and Zoölogists, these minute fossil forms, of which we propose to give a brief account, had received but little attention, and very little was known in regard to them, ten years ago. The fact of their being so long overlooked by collectors of other fossils in the same strata where they are now found together, may be explained by their almost microscopic minuteness and invariably being detached, so far as now known, from their original position in the head of the animals to which they belonged. The published researches of Dr. Newberry and Dr. Hinde (referred to below) have stired up an interest in these fossil jaw plates and teeth that is not likely soon to flag, and is sure to lead to further important investigations and discoveries.

In 1856, Dr. Henrich Pander, of St. Petersburg, Russia, published the first account of Conodonts, which he considered to be the teeth of small sharks, which view has not been accepted, generally, by other Paleontologists.

Dr. J. S. Newberry ("Pal. of Ohio." Part II., p. 41–44, 1875) says, that Conodonts were found in great numbers in the Cleveland shale of the Waverly group—subcarboniferous—at Bedford, Cuyahoga Co., O , and that in regard to their Zoölogical relations it is yet quite impossible to speak with certainty. When first discovered Dr. N. submitted them to Prof. Agassiz, who pronounced them the teeth of Salachians. Prof. Owen (Pal., p. 116) says, that they have most analogy with the spines, kooklets or denticles of naked mollusks or Annelids. Prof. E. S. Morse—as possibly the teeth of naked mollusks, such as *Doris*, *Acolis*, etc., and that they bear a strong resemblance to the teeth of mollusks, and might have be-

longed to the progenitors of our living forms. Prof. Stimpson—that they might very well be the lingual teeth of mollusks, but could not have formed the dentition or spinous armament of any Crustacean. Some Zoölogists have suggested that these singular bodies are the teeth of Cyclostomous fishes, and others that they are dermal Ossicles.

Dr. Newberry discusses quite fully the different views in regard to Conodonts, and comes to the conclusion that more proof is needed to establish their true position.

Mr. E. O. Ulrich (JOUR. OF THE CIN. SOC. NAT. HIS., Vol. 1., July, 1878,) described and figured several forms that he considered "*Annelids*" under the new genus *Protoscolex*, U., but these were the *bodies*, not teeth or jaws.

The two species of so-called "Annelids" described and figured under the new genus *Walcottia*, Miller and Dyer—W. *rugosa* and W. *cookana*, M. and D. (JOUR. OF THE CIN. SOC. NAT. HIS., April and July, 1878). And W. *sulcata*, James (The Paleontologist, June 10, 1881,) are, probably, no more than the burrows of marine organisms.

Dr. George Jennings Hinde, F. G. S., probably the best authority on the subject of Conodonts and fossil Annelid jaws, published the results of his *extensive investigations* of the large collections made by himself. (*Quart. Jour. of the Geol. Soc. of London*, Vol. XXXV., p. 351, 1879). "*On Conodonts from the Chazy and Cincinnati Groups of the Cambro-Silurian and from the Devonian and Hamilton and Genesee-Shale divisions of the Devonian in Canada and the United States.*"

In this valuable paper Dr. Hinde alludes to the discovery of Conodonts by different persons at different times, and says that Conodonts were first noticed in America by Dr. J. S. Newberry (Pal. of Ohio, as quoted above).

"The appearance of the American Conodonts are so similar to those from Russia that Pander's descriptions will almost equally apply to both. They occur as very minute, shining bodies, sometimes consisting of a single, more or less conical tooth with an expanded base; but more frequently they possess an elongated basal portion, in which there is generally a large tooth with rows of similar or smaller denticals on one or both sides of the large tooth, according as this is central or at one end of the base. In some forms the large tooth is continued below the level of the base, forming one or more small, blunted extensions; and in one of the Devonian forms this extension is greatly prolonged and also supported denticles. In other examples there is no prominent central tooth; but the series of more or less similar teeth are carried on a straight or curved base."

* * * "The smooth and undisturbed outline of their bases plainly

indicates that they have not been broken from the edges of the carapace of any crustacean."

They are brittle and dissolve slowly in nitric acid. Mostly of a reddish horn color and translucent. Rarely white, though white is the usual tint of the Ohio Carboniferous specimens, and common in the Russian specimens. The Chazy specimens are of a black, glossy tint.

Prof. Huxley suggested the possibility that they might be the teeth of "Hag fish."

Dr. Hinde continues: "That, however, the *Conodonts* can not be referred to the horny jaws of *Annelids* may be conclusively shown by the discovery, by the writer, of these Annelidian structures in the same strata with Conodonts, from which the former can readily be distinguished by their chemical composition and their resemblance to the jaws of existing Annelids." Our present knowledge of facts is insufficient to decide the question as to the low type of fish teeth.

"Owing to the uncertainty respecting the animals to which the Conodonts belonged, any arrangement of the teeth themselves must almost entirely rest on an artificial basis, and, consequently, possess little Zoölogical value; detailed descriptions and figures, however, * * are of great importance and service for Paleontological reference."

Some of the difficulties in attempting to classify these minute fossil objects may be appreciated when it is understood in what an isolated, detached condition, from the bodies to which they belonged, they are found.

Different parts of the compound jaw apparatus scattered over and through the rocky strata, and never discovered in such a position as to establish the fact of their belonging to a single animal.

Dr. Hinde says in his paper "*On ANNELID JAWS from the Cambro-Silurian, Silurian and Devonian Formations in Canada and from the lower Carboniferous in Scotland*" (*Quart. Jour. of the Geol. Soc. Lond.*, Vol. XXXV., 1879,) that Dr. Ehlers published an account of fossil errant Annelids in 1867; and Prof. G. B. Grinnell, of Yale College, Conn., described (*Am. Jour. of Arts and Sciences*, September, 1877,) two specimens of Annelid jaws from the Cincinnati Group (Cincinnati, O.,) which he constituted the types of a new genus, *Nereidavus*.

Description of the Jaws. "The Annelid jaws occur as small, dark, shining objects, very varied in form, disposed through the rock, quite detached from each other, and from the positions they occupied in the head of the animal." Are of a bright, glossy black tint, but when much weathered the black is changed to a rusty, reddish tint. Composed of chitinous matter, and undergo no change in nitric acid.

"After careful comparison of these fossil jaws with recent examples of the order Annelida Polychæta or Nerida, I find specimens belonging to the families of *Eunicea*, Grube; *Lycoridea*, Grube; and *Glycerea*, Grube. * * * The only genus represented in the family Lycoridea, as fossil is *Nereidavus*, Grinnell."

Dr. Hinde published another valuable contribution on this subject the following year (*Quart. Jour. of the Geol. Soc. Lond.*, Vol. XXXVI., 1880), "On Annelid Jaws from the Wenlock and Ludlow Formations of the West of England," in which he says there is no striking difference in *form* of the English fossil jaws and American, but, as a rule, the American forms are the larger.

And another in 1882, "On Annelid Remains from the Silurian Strata of the Isle of Gotland, Communicated to the Royal Swedish Academy of Sciences," which was published in Stockholm, in pamphlet form, with three plates of 77 figures. This paper contains the result of collections made by Dr. H. himself in the Isle of Gotland. He found the Annelid remains similar to those already described from England and North America, many of them identically the same species; detached and scattered through the rocks in the same confused manner. He says: "Until some complete forms are discovered, showing the constituent plates of the jaw-armature in their relative positions, which, judging from my own experience, seems at present unlikely, we shall have to be content with a description of these detached jaw plates based upon their nearest resemblance to those of existing forms."

After listening to the reading of Dr. Hinde's papers (published in the 35th volume of the *Quart. Jour. Geol. Soc., Lond.*,) Dr. Woodward expressed his admiration of the labor and research displayed in these papers. He was satisfied that the conclusions as regards the Annelid jaws were correct; but that the Conodonts belonged to Myxinoid fishes he thought was more doubtful, and suggested that they might possibly be the lingual armatures of Nudibranchs. Though some of the Annelid jaws were not unlike the maxillipeds of Crustacea, the Conodonts had no such resemblance."

The weight of evidence seems to favor the view that *Conodonts* are the jaws and lingual teeth of Mollusks, and that the objects referred to *Annelids* belonged to very different organisms.

Some important facts and suggestions bearing upon this subject may be found in the August number, 1884, p. 776, of the *American Naturalist*.

"*On the Constitution of Some Appendages of the Mollusca*," by Prof. W. H. Dall.

Both Conodonts and Annelid jaws are found together, in the same

strata of the Cincinnati group, in the southwestern part of Ohio, but not, what may be considered, abundantly. The writer has noticed, also, in the same beds the "dark chitinous fragments" that Dr. Hinde refers to as, probably, the skin of the animals. A number of the specimens found in these beds I am able to identify as Dr. Hinde's species, by the aid of his clear descriptions and excellent figures, but others I have not yet succeeded in identifying. Four of these seem so decidedly different that I venture to describe and figure them as new species.

CONODONTS.

GENUS PRIONIODUS, PANDER, 1856.

PRIONIODUS DYCHEI, Sp. nov.

(Plate VII., figures A & B.)

The jaw of this species seems to be nearly entire, showing both the right and left sides, and prolonged anteriorally into a curved hook or tooth, standing at nearly a right angle with the jaw plate, and curved slightly inward. (See fig. A.) On the right side, viewed from the posterior end, there are six teeth, three of which are broken away just above the jaw plate, the stumps showing clearly, as seen in the figure (A). The other three project to nearly the height of the anterior curved hook, but are broken at the tops, as is the hook, as shown by the fractured apices. The portions broken away are evidently slight; this side of the jaw is linear; the teeth have a backward slope. In the other side of the jaw there are stumps of five teeth. It curves slightly outward from about the middle to the posterior end, and appears to have been broken off, as it is slightly shorter than the right side, and has one less dentation.

Length of jaw a little over $\frac{1}{16}$ of an inch; width, measuring from the crest of the long teeth to the base of the left side, is about $\frac{2}{3}$ of the length.

The teeth and upper portion of the anterior hook are of a light horn color, translucent and have a bright shiny luster; the jaw plate a lustrous black.

The type specimen (fig. A) used for this description was found in the upper part of the Cincinnati group, Warren Co., Ohio, by the Hon. Wm. W. Wilson, of Lebanon, that county. The other specimen (fig. B) was found by the writer near Eden Park reservoir, Cincinnati. The vertical range between the two localities, according to Prof. Orton's tables in Volume I., Ohio Geology, 1873, is over 500 feet.

By special request of Judge Wilson, the writer takes great pleasure in naming the species in honor of our highly esteemed friend Dr. D. T. D.

Dyche, of Lebanon, who has done so much in collecting and developing many of the finest Crinoids, etc., found in the Cincinnati group, and to whom we feel under great obligations for valuable information and other kind attentions.

GENUS POLYGNATHUS, HINDE, 1879.

POLYGNATHUS WILSONI, Sp. nov.

(Plate VII., figure C.)

Jaw plate arched above and a little so at the base, with a slight projection or prominence near the middle; seven strong teeth in the upper arched portion of the jaw, the three central ones being entire, the other four (two on each side of the three) partly broken away, all standing at angles corresponding, mainly, with the curve of the arch. (See figure C.) The teeth are of a light, shiny horn color, translucent; the jaw below the base of the teeth black and glossy; the most prominent of the three perfect teeth, however, is of a dark color part of the way upward from the jaw. Length of jaw $\frac{1}{16}$ of an inch, height from base to top of longest tooth $\frac{2}{3}$ of length.

Another example has the lateral teeth, seemingly perfect, but owing to the rock, in which it is partly embedded, being of a similar light shade, it is different to determine this point positively; in other features and size it is nearly identical with the first.

The specific name is given in honor of Hon. Wm. W. Wilson, of Lebanon, Warren Co., O., who found the three specimens used for this description in the upper part of the Cincinnati group, at the same locality as the preceding described species.

ANNELIDA POLYCHÆTA.

GENUS ARABELLITES, HINDE, 1879.

ARABELLITES ACICULATUS, Sp. nov.

(Plate VII., figure E.)

The jaw plate has a comparatively long hook anteriorly, curving quite sharply inward. A regular curve from the point of the hook to the upper margin of the jaw and to the first dentation, forming almost a semi-circle, where the outline arches gently back to the posterior extremity. Seven short teeth, of irregular lengths, having a marked backward slope occupy this upper arched portion of the jaw. The curved outline from the top of the hook in front downward extends to a pointed shank below, about one-third the distance backward, where the lower margin curves upward, then backward to the posterior extremity. Quite a sharply defined ridge

extends from the point of the hook to the posterior end. Color of jaw a glossy, jet black. Size a little over $\frac{1}{16}$ of an inch in length, width less than the length.

This beautiful little fossil seems to be perfect, and is remarkable for the very delicate anterior hook, which is as sharply pointed as a fine needle, and stands out free from the rock to which the posterior end is slightly attached.

Position and locality. Bed of a "run" in Warren Co., O., near the Clermont Co. line, about four miles from Loveland. Cincinnati group. Found by the writer.

ARABELLITES HINDEI, Sp. nov.

(Plate VII., figure D.)

Jaw with a prominent, prolonged tooth in the anterior end, which stands at nearly right angles with the jaw, and is slightly curved inward at the point; just below the point is a regular curve forward and downward to the *base* of the jaw (as fig. D is placed). Back of the hooked-tooth are six small but conspicuous teeth, three of them standing erect, the other three slope backward the middle one (longest of the six) at a lower angle than the others; back of the sixth dentation, near the posterior end, is a slight elevation in the jaw which may be an immature tooth. In the posterior end of the jaw is an indentation extending to near the middle, causing an apparent pointed projection of the base. A longitudinal ridge, about the middle of the jaw, extends from the posterior end to the base of the anterior long tooth. Color of the jaw a shiny, jet black. Length $\frac{3}{32}$ of an inch, width $\frac{1}{3}$ of the length.

The very fine specimen used for this description is partly embedded in rock at the posterior end, but the other end stands out free. It was found by the writer in the bed of a "run" in Warren Co., O., about four miles from Loveland, Clermont Co., O., in the Cincinnati group.

The Journal of the Cin. Soc. Natural History.
VOL. VII. Plate


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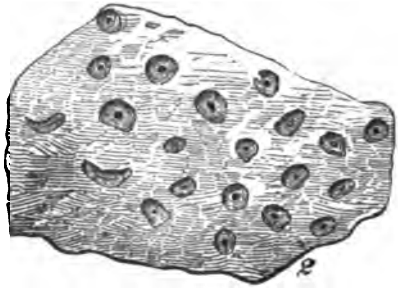
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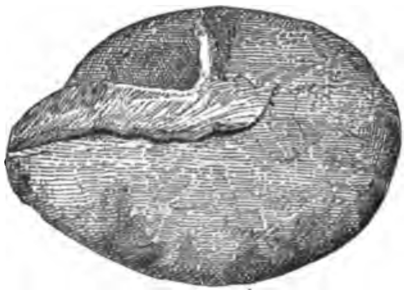
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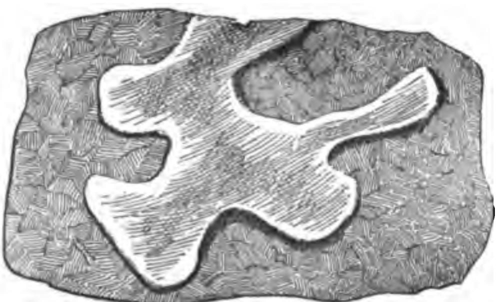
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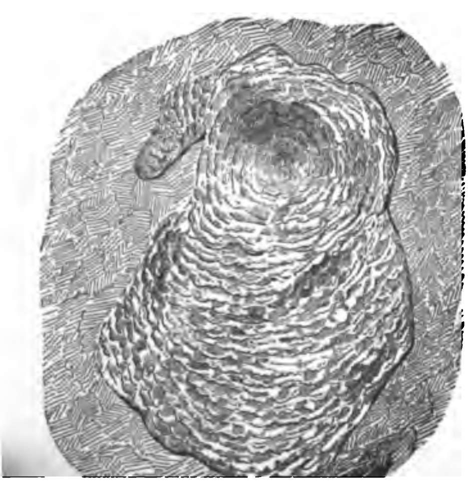

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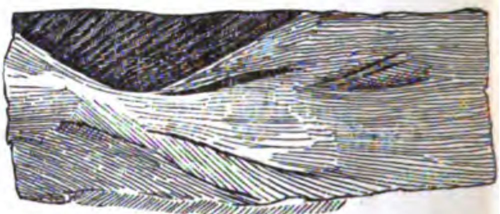

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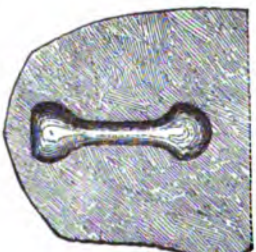

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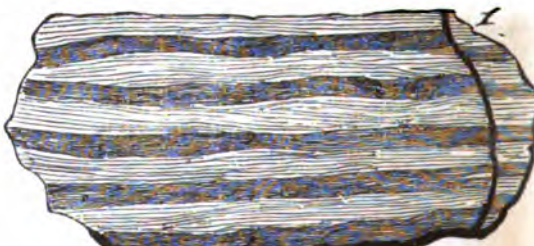

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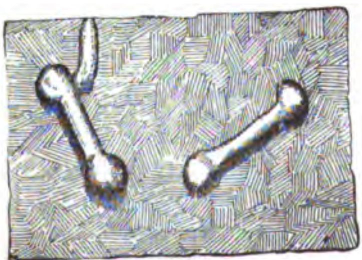

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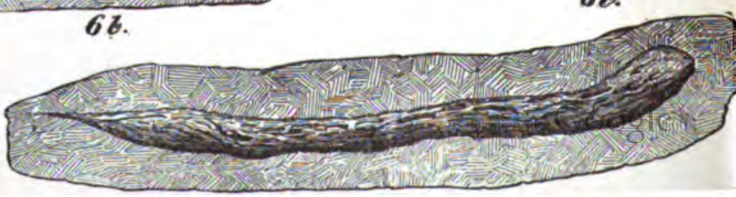

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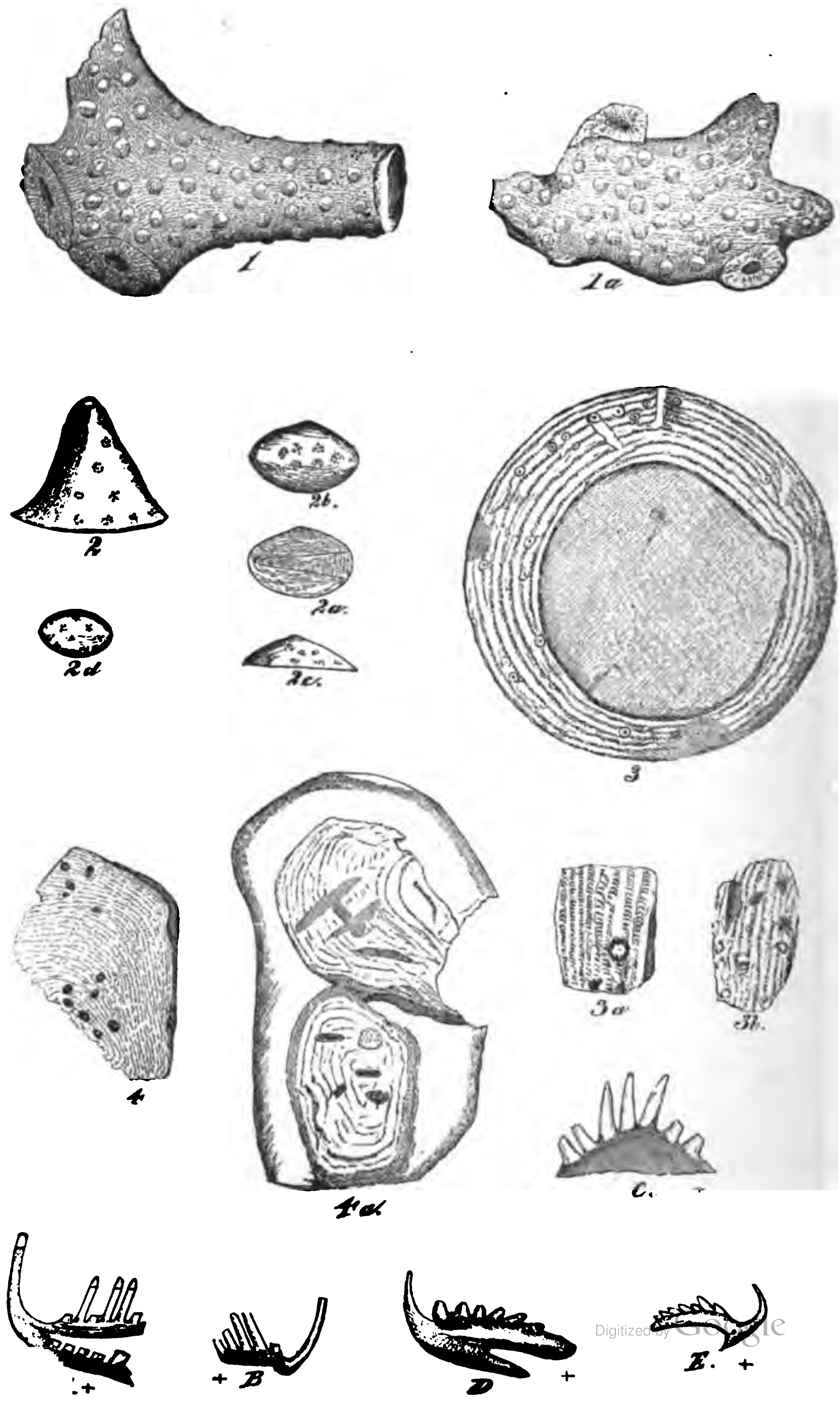
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Vol. VII. No. 4.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee.

JAMES W. ABERT, A. P. MORGAN,
GEO. W. HARPER, WALTER A. DUN,
JOSEPH F. JAMES.

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Calendar for January to April, 1885:—

Tuesday, January 6.—Business and Scientific Meeting.
Tuesday, January 20.—Executive Board Meeting.
Tuesday, February 3.—Scientific Meeting.
Tuesday, February 17.—Executive Board Meeting.
Tuesday, March 3.—Scientific Meeting.
Tuesday, March 17.—Executive Board Meeting.
Tuesday, April 7.—Annual Meeting for Election of Officers.

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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. VII. CINCINNATI, JANUARY, 1885. No. 4.

PROCEEDINGS OF THE SOCIETY.

TUESDAY, *October* 7, 1884.

William Hubbell Fisher, President, *pro tem.*

Prof. A. D. Morrill, College Hill, Ohio, was proposed for membership.

A committee of three, composed of Prof. Jos. F. James, Edw. M. Cooper and Dr. Walter A. Dun, was appointed by the Chairman to arrange a course of free lectures during the winter.

The Librarian, A. E. Heighway, Jr., made some remarks relative to a recent visit to Washington.

The following papers were read and referred to the Publishing Committee:

FUCOIDS OF THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,
Custodian of the Cincinnati Society of Natural History.

(Concluded from page 132.)

RECENT BURROWS AND TRAILS.

Next to mud markings on recent flats and river banks, those referable to trails and burrows come to be considered.

One of the first things to be noticed in studying these marks, is the wide difference in the appearance of those made on the very soft mud nearest the water, and those on that higher up and partially hard and dry. On the surface of the first the tracks have no shape at all; they form irregular depressions, which, higher up on the bank, appear definite. Here there is considerable room for errors in identification of certain marks, for those made by the same animal form would appear unlike in both places. It

would be only by observing the gradual passage of the one into the other that their true origin could be recognized.

Sir Charles Lyell, (Principles of Geology), has noticed in the Bay of Fundy the tracks made on the mud by various forms of animal life, and has stated that these marks are often well preserved by the deposition of mud by the tide. Many similar markings, made by different forms, have been noticed in studying mud banks, and reference will here be made to them in detail.

Trails made by mollusks of various sorts are most abundant. That made by a small lamellibranchiate shell (Cyclas) forms a series of semi-circles, as if the animal, in moving, had wriggled along in a one-sided manner and left its peculiar mark (Plate 8, figure 4). Still another, probably made by a Melania, is a broad, winding, sinuous trail, depressed in the center and elevated at the edges (Plate 8, figure 8). It is sometimes three feet in length, and twists and turns in all imaginable directions. Sometimes it ends abruptly, as if the animal had burrowed under ground and intended to appear in another spot.

Still another sort of trail, also probably made by a mollusk, turns and twists on itself and forms a series of interwoven loops or circles (Plate 8, figure 5). Still another sort forms a broad track, depressed in the center, elevated at the edges and marked outside by a continuous series of small depressions (Plate 8, figure 7). This is probably made by some sort of a many-legged creature, such as the hard-cased worms which live in rotten wood. Another trail is a long, sinuous line like the crenated edge of a leaf, and is probably also made by a mollusk (Plate 8, figure 6).

All these markings are very different from the true burrows, so common on all mud banks. Some of these are long and continuous, branching here and there, turning from side to side, or back on themselves, as it may happen. Those which have been noticed are made by beetles and a small larva, and differ considerably in appearance. They assume at the same time a different aspect, as they are covered or uncovered. In the first instance a regular series of transverse lines, formed by the small particles of mud thrown up in the course of the excavation by the insect, gives a reticulated appearance to the burrow, as shown in Plate 9, figure 1; but when this top is taken off, all the reticulations disappear, and there is left simply a hollow, having the same general form as at first, but being plain on the top and wider than before uncovered (Plate 9, figure 2). Unless it was understood that the difference in appearance was thus caused, it might be supposed that the two were the results of the work of different forms of life.

The burrows of the beetles are generally longer than those of the larvæ, and are made in a different way. Instead of the transverse lines noticed in the larvæ burrows, the mud seems to be thrown up in a series of pellets, arranged in lines sloping backward from the center, and thus giving quite a different appearance (Plate 8, figures 2a and 2b). Uncovered, as in the case of larvæ burrows, they also assume a very different aspect.

It has been noticed in a basin of muddy water that, on the settlement of the sediment to the bottom, it is often arranged in curious, irregular shapes by the small inhabitants of the water (Plate 9, figure 3). It would seem that these animals make their burrows by gathering the small particles of mud together and cementing them in some way that allows considerable stretching before breaking up. These burrows begin and end abruptly, and follow no regular pattern or design in the arrangement of the mud particles.

FOSSIL TRAILS AND BURROWS.

Having now noticed some of the markings on modern banks, it will be found that on ancient coast lines similar ones were made. Professor Hall, in the *Palæontology of New York* (Vol. II.), gives a number of plates showing the markings to be noticed on the rocks of Clinton and other formations. He recognizes that some of these are animal burrows and some trails; but he has, at the same time, erroneously identified as plants certain other markings which were found in rocks of lower formations. It is to errors like these—not alone of Professor Hall, but of others who have followed him—that attention will now be directed. It is likewise the intention to confine the present notice to such of these markings as are found or have been described as plants from the rocks of the Cincinnati group. It has already been intimated that there can be little objection to the naming and describing of burrows and trails, or Ichtholites, as long as they are regarded in their true light; but it certainly is neither logical nor scientific to speak of and refer to them as Algæ, when they have no connection whatever with the class. Taking the genera up separately, and examining each, will be the best way of showing the errors which have arisen from a misconception of the true character of these fossils.

Genus Rusophycus, Hall. 1842.

The genus *Rusophycus* was described by Professor James Hall in Vol. II. of the *Palæontology of New York*, page 23. He considered the fossils referred to the new genus to be plants or parts of plants. He gave as the generic character, "Plants consisting of simple or branched stems, which are transversely rugose or wrinkled." The genus was, at the same time,

made to include some remarkable ovate forms which have been the ones best known as species of the genus. These two species are *Rusophycus bilobatum* and *R. pudicum.* In the former the general outline is elliptical, with the surface sometimes nearly smooth, sometimes very rugose, and the specimens varying in size from an inch long and half an inch wide, to four inches long and three inches wide. A longitudinal groove runs the whole length of the fossil, dividing it into two distinct lobes. Occasionally an apparent stem is found attached to the central depressed groove, but generally this is absent. The distinguishing feature is the bilobate form.

In the latter species (*pudicum*) the specimens are also elliptical, are generally much smaller, smooth, and with the groove deep in the center, but disappearing before either end is reached.

Two other species of the genus were described by Professor Hall, viz., *R. clavatum* and *R. subangulatum.* These are quite different in appearance from those already noticed. Instead ot being elliptical they are elongated, very many times longer than wide, with a depressed line along the center and obscure transverse ridges. In the JOURNAL of this Society (Vol. I., p. 25) Miller and Dyer described another species of the genus under the name of *R. asperum.* This differs from all those of Hall, in being quite rough, with "numerous papillæ," and lacking the transverse rugæ or wrinkles. In the Palæozoic Fossils of Canada (Vol. I.), Dr. Billings characterized a species under the name of *R. grenvilensis.*

After Hall had described and figured his species, it was found that D'Orbigny had, in 1842, described similar forms under the name of CRUZIANA. According to the rules of nomenclature this name must be used instead of *Rusophycus*, and to it all the species should be referred.

Under this last generic name Billings has described one species from Canada (Palæozoic Fossils, Vol. II.), viz., *C. similis.* This is similar to *bilobata* and *pudica*, in having the longitudinal line and the transverse rugæ, but differs in being longer and not elliptical. Dr. Charles White, in the Palæontology of Wheeler's Survey West of the Hundredth Meridian, describes and figures two other species of *Cruziana*, more like the ones of Hall. These two are *C. Linnarsoni* and *C. rustica*, and are from the Primordial Sandstone of Arizona. Both are elliptical in shape, and the first approaches *C. pudica*, while the last is close to *C. bilobata*, though the rugæ are more numerous and closer together. Neither of these show any traces of a stem.

Principal Dawson, of Montreal, in the *Canadian Naturalist*, proposed for these forms the name of RUSICHNITES, and in Acadian Geology, pp. 257 and 410, figured two species from the Carboniferous. One of them he

called *R. carbonarius.* It is quite small—about a quarter of an inch wide and but little longer, with the groove separating the lobes to a considerable extent. The other is *R. acadius.* This is longer, sinuous, with a deep line in the center and the elevated sides cut into small pieces by deep cross lines. The name of Principal Dawson can not be well used for such forms as Professor Hall has described, the name *Cruziana* of D'Orbigny being much the oldest of all. The last species, *R. acadius*, differs so much from the others that it can scarcely be included in the same genus.

Having noticed all the species of the genus known from America, a new species is here described.

CRUZIANA CARLEYI, N. Sp. (Plate 8, figure 1.)

Form elliptical, a little longer than broad; longitudinal furrow, extending almost from one end quite to the other, and there separating the lobes; center of the furrow broadened from a mere line out into an oval, about three quarters of an inch wide and one and one-half inches long; and then narrowing to the lower end, where it again flares out. Inside of this oval, on each side of a furrow in the center, are seven or more small ridges, separated by corresponding depressions. The upper end of the fossil is rounded; the lower is separated into two parts, each of which is rounded off in a regular manner; the tops of the lobes are nearly smooth, without any transverse rugæ.

This species differs from all the other described species, in being entire at one end and separated into two lobes at the other; and also, and especially, in having the seven or more pairs of elevations and depressions arranged in an oval in the center of the longitudinal groove.

The description is drawn from a specimen in the collection of the Cincinnati Society of Natural History. Mr. U. P. James has another and very similar one. His is wider and not so long in proportion, and the central oval is correspondingly broader and has ten instead of seven depressions. The specific name is given in honor of Mr. S. T. Carley, who presented the specimen to the Society a number of years ago. He collected it in the rocks of the Cincinnati group near Bantam, Clermont County, Ohio.

Character of CRUZIANA.

The fossils described under *Rusophycus* and *Cruziana* have been considered as belonging to the Algæ. Hall, Billings, White, Miller and others have so placed them. Dana, in his Manual of Geology (page 225), speaks of them as trails of articulates; and Dawson, in Acadian Geology, calls them impressions of trails of trilobites.

That they are not fucoids may be considered as settled definitely, and

that they are trails, or impressions of trails, of some sort of articulates, may be considered as probable. But what sort of articulates, is problematical. From the evidence now at hand, it seems likely that they are casts of trails of trilobites, or else casts of their bodies. Since the discovery of the locomotory appendages of the trilobite in the Oxford specimen,* a better idea can be formed of how the trail would look than it could before. Obscure specimens, undeterminable in themselves, become explainable when viewed through more perfect specimens. A fossil in the collection of this Society, long referred to the fucoids, is now recognized as a cast of the remains of the locomotory appendages of an *Asaphus*, such as was found at Oxford. Similar features in other specimens seem to show an approach to such remains. Some of these other specimens are very like species of *Cruziana*. Especially is it so with *C. Carleyi*, n. sp., though in this the heavy lobes on each side seem to militate against its having its origin there. Still, all analogies seem to point to some of the forms referred to *Cruziana* as the remains either of trilobites or else their trails. If the first, they still retain the shape, though they have lost all the outside shell.

Cruziana (*Rusophycus*) *subangulata* and *C.* (*R.*) *clavatum*, are two species described by Hall in *Palæontology of New York*, Vol. II. One is evidently synonymous with the other, the differences being merely in length. The first is longer and more regular than the last, but this constitutes the main difference. Neither one is a fucoid. Both are trails of Gasteropods, similar to those produced at present by Melania. The depressed line along the centre, with the corresponding elevated margins, are just what would be produced by the passage of the foot of a Gasteropod over soft mud. The first (*subangulata*), has not before been recorded from this vicinity, but last spring a rock was found at Ludlow, Kentucky, containing undoubted specimens of it.

Cruziana (*R.*) *aspera*, S.A.M., is neither a fucoid nor a track. It is a burrow, made by some one of the numerous annelids which lived on the Silurian sea-beaches, and which have left only their jaws in the rocks to tell the tale of their having lived. This species is rough on the upper surface with numerous papillæ, these having no doubt been caused by the mud or sand thrown up in the course of the making of the burrow. (Plate 8, figure 3). There is no sign of branching, but the burrows often cross each other at various angles. There is a slight depression down the centre, and the sides are elevated above the level of the rock, as would naturally be the case with a burrow made just beneath the surface.

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*See this JOURNAL, Vol. VI., p. 200.

The other four species, viz., *C. similis*, and *C. Grenvilensis*, Billings, from Canada, and *C. Linnarsoni*, and *C. rustica*, White, from Arizona, are likewise trails of some sort, but not having been found in this vicinity, do not at present come under consideration.

Here now in this genus there are eight species which have been referred to the Algæ, and which can be disposed of as follows:

Cruziana (Rusophycus) pudica, Hall.		Crustacean Trail.
C........	(R.) bilobata, Hall.	" "
C........	(R.) grenvilensis, Billings	" "
C........	similis, Billings.	" "
C........	rustica, White.	" "
C........	Linnarsoni, White.	" "
C........	(R.) subangulata, Hall. (Syn. R. clavatum, Hall).	Gasteropod trail.
C............aspera, S. A. M.		Burrow.

Lastly, Cruziana Carleyi, n. sp., is propably the trail of an *Asaphus*.

Genus Saccophycus, James. 1879.

This genus was established by Mr. U. P. James, in the *Palæontologist*, p. 17, for a fossil with an "eneven, undulating surface, smooth or striated longitudinally," "the sides or ends rounded and drawn in and under." One species, *S. intortum*, was described. In the absence of figure or specimen, (only the type having been found), it is difficult to decide what this may have been. But from the description it is inferred that it is the burrow of an annelid instead of a fossil plant.

Genus Palæophycus, Hall. 1847.

The genus Palæophycus was characterized by Hall, in Vol. I., *Palæontology of New York*, p. 7, as having a terete, simple or branched, cylindric or sub-cylindric stem, the surface nearly smooth, without transverse ridges, and apparently hollow. A large number of species have been referred to the genus and considered as plants, but it is doubtful if a single one of them is a true Alga. From the rocks of this vicinity five species have been recognized, and these are arranged as follows:

Palæophycus flexuosus, James, has already been shown to be a ripple mark. (This Journal, Vol. VII., p. 129).

P. tubulare, Hall, is described as having a tapering cylindric stem, bent, flexuous and branched; the surface nearly smooth and the branches generally compressed.

P. rugosus, Hall, has a sub-cylindrical stem, with divergent cylindrical branches. The surface is very rugose, and the branches are flexuous.

There can scarcely be a doubt but that this species is the burrow of some sort of annelid. The rugose surface would be caused by the irregularly thrown up mud; the flexuous stem and the branching, by the windings of the worm. Burrows precisely like the specimens of this fossil have been noticed by the writer on muddy banks of the Little Miami River, and all facts point to the conclusion that instead of its representing the remains of an Alga, it is an ancient burrow.

The different appearance presented by the complete burrow and the same one with the top taken off, exposing the excavation, has been referred to, and in *P. tubularis* is to be found the *P. rugosus*, treated in this way. In other words, *P. rugosus* represents a complete burrow and *P. tubularis* one of the same sort, showing the hollow instead of the ridge.

P. simplex, Hall, with simple, cylindrical, flexuous stems, with the surface smooth or rough, can be referred to the same source as the preceding two species, and was likely made by the same animal form. Certainly the characters distinguishing the *tubularis* and the *simplex* are insufficient to separate them.

P. virgatus, Hall, described from the Hudson River group of New York, was found in the spring of 1884, by the writer, near Ludlow, Kentucky. The specimens were about an inch wide, and about eight inches long, of the same width their whole length, were slightly curved, and overlying one another in various directions. It is difficult to imagine what this fossil could have been, though it is not likely that it was a plant. It is more like the impression of a large Solen than anything else.

Genus Trichophycus, M. and D. 1878.

This genus, established by Miller and Dyer, in Journal of Cincinnati Society of Natural History, Vol. I., p. 24, has included three species, of which *T. lanosum* was the type. Two of the species, *T. venosum* and *T. sulcatum*, have already been referred to under mud markings (this Journal, Vol. VII., p. 131), and the third, or the type of the genus, no more a plant than the other two, is an evident burrow. The "plant" or fossil, according to the description, consists of a "round, flexuous stem, with a spheroidal swelling at one end," the surface being covered with "diagonal and longitudinal lines, as if made by the folding down of hair-like filaments." It seems most probable that these lines represent the arrangement of the mud particles thrown up during the making of the burrow. They are similar in appearance to the marks on *T. venosum*, but hardly referable, as that is, to rill marks, on account of the curving and twisting of the fossil. (Plate 9, figure 4).

Another genus, *Blastophycus*, was established by the same authors at the same time and in the same article as the preceding, and one species was described. It consists of a bud-like protuberance at the end of a stem or two stems, and bears so much resemblance to the enlarged end of *T. lanosum*, that there is little doubt about its being the same thing. The fact of its being so fragmentary and having so close a resemblance to *lanosum*, is sufficient reason for putting them together.

Genus BUTHOTREPHIS, Hall. 1847.

The genus *Buthotrephis* was characterized in 1847 by Professor James Hall, in *Palæontology of New York*, Vol. I., p. 8. It included certain fossils or "plants," with sub-cylindric or compressed, branching stems. Since the establishment of the genus, a number of species and varieties have been described, and five have been recorded as found in the Cincinnati group. Of these five, two are burrows of annelids, two are Graptolites, and the other is a water mark. None of the five are plants, and it is doubtful if *any* of the forms referred to the genus are Algæ.

Buthotrephis ramulosa, S. A. Miller, was described in the *Cincinnati Quarterly Journal of Science*, Vol. I., page 235, as a plant consisting of short-branched fragments, smooth or rugose, and scattered irregularly over and through nodules of indurated clay. From its general aspect it doubtless represents the burrows of some animal form. Parts of the burrows are on the surface, and parts below it, as if the worm had dived beneath the surface and come up again in another place.

B. succulosa, Hall, was described in the *Palæontology of New York*, Vol. I., p. 23, as having thick, succulent, branching and apparently hollow stems. It is evidently a burrow. It assumes various forms. Those described by Hall as *B. palmata*, and *B. impudica*, (*Ibid*, Vol. II., p. 20), are evidently the same as *B. succulosa*, though they come from a different horizon.

B. filciformis, James, described in the *Palæontologist*, p. 9, as a fossil with a slender, curved stem, with lateral branches set at an angle of 45 degrees to the stem, is referred, in the absence of figure or specimen, to the water mark called *Chloephycus*, as already adverted to. (This JOURNAL, Vol. VII., p. 130).

The remaining two forms, *B. gracilis*, and its variety *crassa*, so long considered as plants, are not plants at all, but Graptolites, belonging to the genus *Dendrograptus*, Hall. A great deal of confusion exists in respect to this species and its varieties, and a full history of it will here be attempted.

In Vol. I. of *Palæontology of New York*, p. 62, was described a species under the name of *B. gracilis*, Hall. In the second volume (p. 18), a second species, the original having been called *Fucoides gracilis*, Emmons, was called *B. gracilis*, and the one in the first volume was renamed, and called *B. tenuis*. Under this second *gracilis* there were described at the same time two varieties, viz., *intermedia* and *crassa*. Finally, in Vol. II., p. 263, *B. flexuosa* was described. All these forms are closely allied, and though from different horizons, seem referable to the same species.

In the description of the *B. gracilis*, it is said that "scarcely any two specimens are alike, and it is difficult to fix upon characters which shall be decisive of specific importance." Professor Hall then goes on to show the gradation from the delicate filiform branches of the species, through ones with wider branches to the variety *intermedia*, and thence through other grades to variety *crassa*. The form he called *B. tenuis* is evidently intermediate between variety *intermedia* and variety *crassa*, and his *B. flexuosa* seems to be a distorted specimen of *crassa*. Taking this view of the species, they may be arranged as follows:

Buthotrephis gracilis, Hall.
var. intermedia, Hall.
var. tenuis, Hall.
var. crassa, Hall.
var. flexuosa, Hall.

Thus there are three species reduced to one with four varieties, which certainly cover the forms so far discovered.

Now if *Buthotrephis* is not a plant, what is it? To answer this ques tion it will be necessary to go back a little.

Some years ago, Professor Leo Lesquereux, of Columbus, described from some specimens found in the rocks of the Cincinnati group of Lebanon, a species which he named *Psilophyton gracillimum*. He referred this to the Lycopodiaceæ, a family of land plants represented during the Carboniferous epoch by gigantic forms of vegetation *Psilophyton* is a genus established by Dawson for certain plants with slender branches. The figure of *P. gracillimum* shows a small, thin stem, with branches at the top tapering to a point. (Plate 9, figure 5). It precisely resembles in its essential features the figure of *Buthotrephis gracilis*, given by Hall. (Plate 9, figure 6). It is considered by Walcott (*Tran. Albany Institute*, Vol. X., p. 21), as a species of *Dendrograptus*, (*D. gracillimum*), and other palæontologists have so regarded it. After describing two new species of the genus *Dendrograptus*, and referring to the undoubted connection of

Psilophyton gracillimum with this genus, Mr. Walcott goes on to say: "The resemblance of these two species [the two new ones], of *Dendrograptus* to Lycopodiaceous plants of the genus *Psilophyton* is very striking and apt to mislead the observer. Their occurrence with Algæ, graptolites, trilobites, and brachiopods in the same layers of shale, in a position indicating their position *in situ*, taken with their graptolitic structure, precludes the idea of their being of other than marine origin." The striking resemblance between specimens of *Psilophyton gracillimum* and *Buthotrephis gracilis*, leads to the inference that they are both the same, and as one has been referred to the Graptolites, the other should be also. Now, in relation to the varieties of *Dendrograptus* (*Buthotrephis*, *Psilophyton*) *gracillimum*, as it should be called, it might be supposed that specimens with wide and divergent branches would belong to other species. But it is well known that all the varieties run, as it were, into each other, so that no clear line can be drawn between them. Further, Lesquereux has described a species of *Psilophyton* under the name of *P. cornutum*, which is probably the same as Hall's variety, *intermedia*. It seems, therefore, in the opinion of the writer, as if all these species and varieties should be placed under one name, that of *Dendrograptus gracillimum*, the name *gracilis* being preoccupied.

Dendrograptus gracillimum, Hall.
(Buthotrephis gracilis, Hall).
(Psilophyton gracillimum, Lesq.).
var. intermedia, Hall.
(Psilophyton cornutum, Lesq.).
var. tenuis, Hall.
(Buthotrephis tenuis, Hall).
var. crassa, Hall.
var. flexuosa, Hall.
(Buthotrephis flexuosa, Hall).

Genus Lockeia, James. 1879.

The genus *Lockeia* was proposed in the *Palæontologist*, p. 17, by U. P. James for certain oblong bodies found lying on the surface of rocks from a certain horizon of the Cincinnati group. They were likened in form to grains of wheat, and were supposed to be parts of ancient Algæ. (Plate 9, figure 7.) From the study of these forms, and from the resemblance they bear to fossils found in other groups, it is likely that in this fossil, long referred to the Algæ, is to be found, what have been called by Hall, Nicholson, and others, the "ovarian capsules" of species of Graptolites;

and so far from their being the remains of plants, they are the reproductive bodies of Hydrozoa. According to Nicholson (Monograph of British Graptolitidæ, Part I., p. 70), the first information respecting these bodies was given by Professor Hall in 1848, when he described what he took to be "reproductive bodies" or "ovarian capsules" of *Diplograptus Whitfieldii.* In 1866, Dr. Nicholson announced the discovery of these "ovarian capsules" in the shales of Dumfriesshire, England. These are described (*Ibid*, p. 72), "when compressed laterally, as oval or bell-shaped bodies, provided at one extremity with a prominent spine or mucro; and the larger examples may be as much as from three-tenths to four-tenths of an inch in length, and from one-tenth to two-tenths of an inch in breadth." They exhibit little or no definite structure. When compressed from above, "they appear as rounded or oval patches, often very definite in their outlines, and exhibiting somewhere within their margin an elevated point, surrounded by several concentric, elliptical or circular rings, disposed with more or less regularity." The specimens of *Lockeia siliquaria* present no concentric or other lines. They are scattered promiscuously over the surface of the shaly rock, are from one-eighth to one-fourth of an inch long, and are from two to four lines wide at the base. Sometimes the ends are prolonged into points, sometimes they are obtuse; sometimes a longitudinal ridge runs along the top, and sometimes there is a slight depression in the center. They lie slightly attached to the rock, and can be easily separated from it. They show no signs of organic structure, and it is likely that this was all destroyed during the process of fossilization. Though unable to assert to what species of Hydrozoa these bodies belonged, it seems probable that they are really fossilized "ovarian capsules" of some of those species which are found so abundantly in the rocks of this group. It has been objected to this, that there have been found no Graptolites in the horizon where the *Lockeia* is abundant; but if the varieties of *Buthotrephis* are really Graptolites, as I believe them to be, then surely in these species the polyparys or stipes are large enough to bear bodies of the size of the *Lockeia.*

Impressions of Organisms.

While many of the "fucoids" have been described from fossil mud-marks, many from annelid burrows and gasteropod trails, a few from Graptolitic remains, still others have their origin in impressions left by organisms on the mud. These come under examination now, and an attempt will be made to clear up the obscurity resting on the nature of some of these forms.

Genus DYSTACTOPHYCUS, M. & D. 1878.

In *Contributions to Palæontology*, No. 2, pp. 2 and 3, Miller and Dyer established the genus *Dystactophycus* for the reception of certain fossils supposed to be plants, and consisting of rhizomes of fronds "mammiform or depressed conical," with the "surface marked by numerous closely-arranged concentric ridges or wrinkles." One species (*D. mammillanum*) was described and figured, and the generic description answered for the specific. It was supposed to be elevated above the surface of the rock one and a half inches; there was no appearance of any branch springing from the apex, and the whole "plant" consisted of this concentrically wrinkled frond, elevated in the center.

From the rocks of the Niagara group, Professor Hall has described a coral which has long been known as *Lichenalia concentrica*. It can now be conclusively shown that certain species of *Monticulipora* have bases which are marked with concentric lines very similar to those of *Lichenalia concentrica*, and there can hardly be a doubt but that they are the same. A figure of Hall's species is given in the *Palæontology of New York*, Vol. II., Plate 40E, which exactly resembles the markings of the *Dystactophycus*. This "fucoid," then, has resulted from the impression of the base of a coral resting on a mud-bank and leaving its mark in the concentric rings The elevated portion is the part extending up into the base of the coral stem, and the outer rings mark the extent of the expanded base. Comparison of Hall's figure and specimens of *Dystactophycus* leave little doubt as to this fact.

Another and yet more striking impression has also been described as a fucoid under the

Genus HELIOPHYCUS, M. & D. 1878.

This is in *Contributions to Palæontology*, No. 2, and *H. stelliforme* is the only species. It has a "star-like frond, without any stem or evidence of attachment," with five rays, each one apparently round and tapering to a point. "They were evidently flexuous," and had rugose markings on the surface—the lines near the body "forming an angle in the middle, and bending forward down the side; farther from the body the lines become arcuate on top, while toward the points of the shoots [rays] the lines are somewhat irregularly transverse." It seems quite evident that this, instead of being the remains of an organism, is simply the impression made by one of the numerous species of star-fishes (*Palæaster*, etc.) which have been found in this group. The lines are probably caused by the arrangement of the plates on the under side of the body; but the surface of the mud not tak-

ing the impression perfectly, the marks of the plates have not been preserved.

Genus Licrophycus, Billings. 1865.

This genus was established by Billings in *Palæozoic Fossils of Canada*, Vol. I., p. 99. The species described had broad, flat branches springing from an apparent stem. The one from this group, however, *L. flabellum*, M. & D. (*Contributions to Palæontology*, loc. cit.), is the only one here considered. The authors do not distinctly call the fossil a plant, but state that the species consisted of numerous slender branches, "springing from a common root or stem." All the branches are transversely wrinkled; sometimes lying in a close bundle, and sometimes spread out in the shape of a fan. The figure given is a fragment of a poor specimen. Better specimens indicate that the branches were flexible and curved. From the best impression seen by the writer (Plate 9, figure 8), he is reminded of the appearance that would be made in mud by the expanded tentacles of a crinoid. The transverse wrinkles have every appearance of it. It is his opinion, however, that the form under study is really the impression of the remains of a species of Graptolite, probably of the genus *Inocaulis*, Hall. It is very different from the *I. plumosus*, Hall, but very similar to a figure given of *I. Walkeri*, Spencer, in *Bulletin of the State University of Missouri*, No. 1, by J. W. Spencer, and found in Canada. The name *Inocaulis flabellum* is suggested for our species, instead of *Licrophycus flabellum.* It is quite evident that it is not a plant, and the probabilities are that it is Hydrozoic in its origin.

Genus Dactylophycus, M. & D. 1878.

This genus, with two species, was described in *Contributions to Palæontology* (loc. cit.) They were called *D. tridigitatum* and *D. quadripartitum.* They are, in the first place, so similar, as to warrant their being placed together under the same name. They were, too, described from mere fragments, and there is no saying how much or how little of the fossil the figures represent. Certainly they are not worthy of a distinct genus; they are not plants; they are similar to a form, figured by Hall, as an undetermined species of *Palæophycus;* and they were named by Orton, in "Geology of Ohio," Vol. I., p. 387, in 1873, *Palæophycus radiata.* They probably represent portions of burrows, if, indeed, they are not wholly inorganic in their origin.

Review.

Reviewing now all these supposed Algæ, there is not a single one which seems entitled to remain in the class. They are referred to three different sources:

First, inorganic causes, including *Aristophycus ramosum* and *var. germanum; Chloephycus plumosum*, and, as a synonym, *Buthotrephis filciformis; Trichophycus venosum, T. sulcatum; Arthraria antiquata*, including *A. biclavata; Discophycus typicalis; Cyathophycus subsphericus; Dystactophycus mammillanum; Heliophycus stelliforme.*

Second, to trails and burrows, as follows: *Trichophycus lanosum*, including, as a synonym, *Blastophycus diademata; Palæophycus radiata*, including *Dactylophycus tridigitatum* and D. *quadripartitum; Palæophycus virgatus; P. rugosum; P. tubulare; Buthotrephis succulosa; B. ramulosa; Saccophycus intortum; Cruziana subangulata*, including species as before mentioned (see *ante*, p. 156); *C. aspera; C. pudica; C. bilobata; C. carleyi.*

Third, and last, to the Hydrozoa, viz.: *Dendrograptus gracillimum*, to include *Buthotrephis gracilis* and its varieties (see *ante*, p. 160) and *Psilophygracillimum; Lockeia siliquaria; Inocaulis (Licrophycus) flabellum.*

Conclusion.

In this paper there has been no attempt to rename any of those species which have attached to them the suffix "*phycus*," to indicate their plant-like nature. It seems a mere piling up of unwarrantable names and a complication of the synonymy to do so. Those whose nature has been shown to be inorganic, should be allowed to sink into oblivion. Those representing trails or burrows are, perhaps, convenient as a matter of reference, but they should no longer be attached to the Algæ; while those here referred to the Hydrozoa should take their places in the class to which *ton* they belong.

Since these investigations were undertaken, and after the major part of this paper was written, I find that Mr. S. A. Miller, in the "Supplement to his Catalogue of Palæozoic Fossils," acknowledges that *Aristophycus* and *Chloephycus* are "probably inorganic." All the others remain in their original places in the class Algæ. I am also informed by Professor Lesquereux, that several years ago the late Mr. Dyer sent him a large box of these fossils, with the request that he describe them. This he declined to do, returning them with the remark that they were too fragmentary and too ill-defined to be of scientific value. Afterward many of these were described as fucoids by Miller and Dyer in the *Contributions to Palæontology*, so often referred to in this paper.

Professor Lesquereux has been kind enough to forward to me a French translation of a memoir written in Swedish by Professor Nathorst. In this memoir are given the results made by Professor Nathorst in endeavoring to produce, artificially, marks found fossil. He succeeded admirably,

and found that many of the fossils previously referred to the Algæ were inorganic in their origin, and that many more were casts and impressions of trails and burrows. It is but fair to state, however, that Saporta, of France, does not agree with Nathorst. The observations in the present paper accord with those of the Swedish naturalist.

After speaking of the character of certain other fossil marks, and referring them to the tracks of worms of different sorts, Nathorst says of the species of the *Contributions to Palæontology*, of Miller and Dyer:

"In the same way all the Algæ of the 'Cincinnati group,' described by Miller in 1874, and with Dyer in 1878, must be either traces of animals or objects of purely mechanical origin. Thus, the *Buthotrephis ramulosus* (Miller, 1874) is of the same species as the greater part of the Chondrites; the *Blastophycus* and the *Trichophycus* are of purely inorganic origin (drops or courses of water?); the *Rusophycus asper* is a track similar to that of the *Synapta* or of the *Nychia*, while the *Licrophycus flabellum* must be the track of a worm, or, perhaps, of an Ophiuridian. The *Dactylophycus* is, perhaps, the molding of worm-holes; the *Heliophycus* might be the impression of a medusa; the *Dystactophycus* is undoubtedly of inorganic origin; the *Chloephycus*, of which I saw a specimen in Sweden, is most assuredly a result of running water (all the stems are turned to the same side); and, finally, the *Aristophycus* can hardly be anything but ridges on the surface of the rock. No one of them has any resemblance to the Algæ; but the American palæontologists, as shown above, have long had the habit of describing all doubtful objects as belonging to this vegetable group, whatever may be otherwise their aspect and their structure."

The above quotation is given as corroborative evidence of the position taken in the present paper. It is desired to have it distinctly understood that my own ideas and theories were developed entirely independently of those of Nathorst, whose memoir I never saw until this paper was nearly ready for publication.

ON COLOR.

BY COL. JAMES W. ABERT.

THIS is a subject of great importance to the student of natural history. In many of the objects which come under his scrutiny, colors constitute an important characteristic. Many of these objects lose their tints and undergo subtile changes of color. We find birds, fishes, shells, insects, plants, and even minerals, characterized and exalted to objects of marvelous beauty by the quality of color.

Light and color possess very important relations to organization and life. But I propose to confine my remarks to the systematizing of an arrangement of colors, which I have found of great practical value, in assisting the student in his attempts to give the proper colors to objects of natural history.

The first three elementary colors, namely: the yellow, the red, and the blue, are called primary colors, and these terms—primary, secondary, and tertiary—not only indicate the order in which the colors stand, but also the character of the combination; for primary designates a simple, elementary color; secondary, a combination of two primaries; and tertiary, a combination of the three primaries—in which one of the said primaries is dominant.

But there is an inherent defect in the nature of our pigments—none are perfect of their kind; the yellows contain some red or blue, the reds contain some yellow or blue, and the blues contain some yellow or red; therefore, in mixing, to get brilliant secondary tints, we must so select the two primaries that the third one does not enter; for this would give us a tertiary, which is more or less dull, in proportion to the intensity of the third color thus added. The great difficulty against which we have to contend, is the vague and indefinite ideas that people have of the primary colors. Very few persons have any idea of what the standard, or typical, colors should be. Take, for instance, red; they call numerous colors red—never mind how different the hues may be; never mind what may be their intensity, whether dark or pale, bright or dull, in light or shadow.

The culture of the eye for color has been grossly neglected. You may take pictures by the most famous colorists of the Venetian school—Vivarini, Carpaccio, Tintoretti, Bellini or Titian—in which the masses of color are appropriately balanced, are perfectly harmonized; diminish or increase the superficial extent of these masses, how few eyes will appreciate any difference. In music, the ear is much better educated; and the slightest sharpening or flattening of a single note which enters into an harmonious

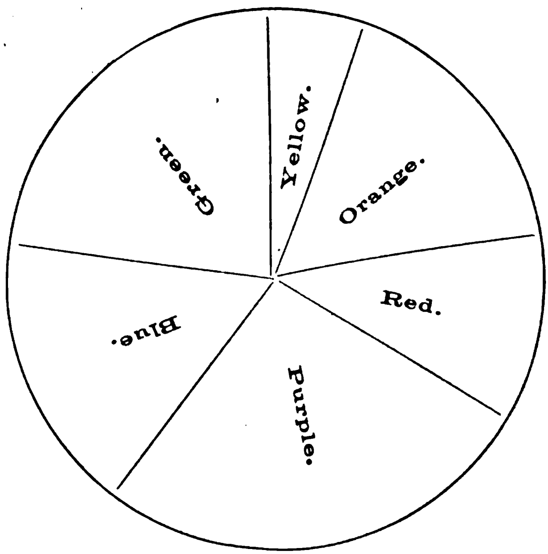
arrangement of chords, or a false note in a melody, is instantly perceived and instantly resented. We must fix our standard of colors by careful study of the spectrum.

If the colors, as obtained from the analysis of the solar spectrum, be arranged on a circular disk, and the proper superficial extent of surface be given to each color, by rapidly whirling the disk, the colors recombine and will produce white; each set of any two primaries will have the proper secondary between them, and the colors pass round and round the circle, conforming to the law for mixing colors. The colors will be found to conform in relative position to the following figure:

Diagram of the relative superficial areas and angular spaces to be given to each color, in order to form an harmonious combination.

YELLOW—1, or 20°;
RED —2, or 40°;
BLUE —3, or 60°;
120°.

ORANGE—3. or 60°;
GREEN —4, or 80°;
PURPLE—5, or 100°;
240°.



J. W. A.

I will now give you some diagrams which, in a condensed manner, will display the classification and combination of the colors, which may be analyzed into an infinite number. Yellow is akin to light, and blue to darkness, while red is the transition color. If you add yellow to any color, it renders it paler; and blue darkens the tint.

In the following diagrams, you will find the lighter colors in the uppermost line, the transition colors in the middle line, and the darkest in the lowest line. The Roman numerals designate the order of position:

Primaries.	*Secondaries.*	*Tertiaries.*
I. Yellow, .	IV. Orange, . .	VII. Citrine, .
II. Red, . .	V. Green, .	VIII. Russet, .
III. Blue, . .	VI. Purple, . .	IX. Olive, .

The arrows indicate the manner in which the colors are combined; *i. e.*, how the secondaries are derived from the primaries, and the tertiaries from the secondaries.*

The following diagram shows the relative amount of superficial space each color should possess, in order to form an harmonious combination:

I. Yellow, . .	1	IV. Orange, .	3	VII. Citrine, .	7
II. Red, . .	2	V. Green, . .	4	VIII. Russet, .	8
III. Blue, . .	3	VI. Purple, .	5	IX. Olive, . .	9

The numerical values attributed to the spaces occupied by the colors, as derived from the solar spectrum, are given of different values by writers on optics; but for practical purposes, the numbers one, two and three give relations that are satisfactory for all our purposes, and readily remembered.

Now, combining these colors by algebraic symbols, we get the following diagram:

I. Yellow,	IV. Y.+R.=Orange,	VII. 2 Y.+B.+R=Citrine.
II. Red, .	V. Y.+B.=Green,	VIII. 2 R.+Y.+B=Russet.
III. Blue, .	VI. R.+B.=Purple,	IX. 2 B.+Y.+R=Olive.

A simple idea of the tertiaries can be obtained by considering them all as grays; for the citrine is a yellowish gray, russet is a reddish gray, and olive is a blueish gray. A pure gray is a true neutral tint, made up of all three of the primitive colors, in such proportions that no one of them is perceived to preponderate.

* Any vertical row of colors is deduced from the row on the left, by combining:
The first and second to form the first.
The first and third to form the second.
The second and third to form the third.
Thus to form the secondaries:
We combine yellow and red to form orange.
" " blue " green.
" red and blue to form purple.
And when we wish to form the tertiaries:
We combine orange and green to form citrine.
" " purple to form russet.
" green and purple to form olive.
In my diagrams and formulæ I had arrows drawn, which by the course they pointed out, designated the manner of mixing the colors; but, as it would be difficult to represent the arrows in type, I hope the above explanations will prove to be sufficiently clear to be understood.

In the masterpieces of olden times, great attention was paid to the harmony of colors; each color possessed a certain intensity, and a certain relative superficial area in every picture. I possess a life-size copy of one of the great Spanish painter's (Murillo) Madonnas. Pale orange, or flesh color, occupies one-tenth of the picture; red, one-tenth; blue, of deep, rich tone, two-tenths; and gray, which surrounds the colors, occupies six-tenths, of the canvas. The main mass of red is placed near the faces of the mother and child, to concentrate attention there.

The Six Colors of the Solar Spectrum.

There are three primary, and three secondary colors. The primaries have never yet been decomposed, hence, are considered elementary colors.

White is produced by all the colors of the prism being recombined.

Black is the absence of all color.

Hues are made paler by mixing them with white.

Darkening hues, by mixing them with black, produces tones of color, and impairs their brilliancy. It should not be done. To darken any hue use darker hues of the same color, then your coloring will be brilliant.

Some colors are of mineral and some of vegetable materials; therefore, the mixing of them may produce abnormal results.

The standard type of any color is to be found near the middle space of that color in the solar spectrum.

The degree of strength of any color is an important point to be fixed.

Some colors in painting are more self-asserting than others; *e. g.*, a very small quantity of indigo has a powerful influence upon other colors.

In mixing any two pigments of the primary colors, those combine best which possess already some of the hue they are mixed with, and hence have an affinity for each other; *e. g.*, the most beautiful purple is formed by mixing indigo and lake, as indigo contains some of the hue of lake, and lake contains some of the hue of indigo.

The high lights on smooth, polished or shining objects, are pure white in outdoor daylight. They reflect the highest light of the luminary.

Guided by this principle, the juxtaposition of colors in paintings, in dress, in furniture, in planning gardens, in bouquets—indeed, wherever colors are employed—ceases to be a matter of accident, or an ill-understood experience, and becomes a subject for rules and the predictions of science.

In all chromatic combinations, harmonies of contrast must first be sought. But as these are limited, harmonies of analogy are also called into requisition, with less striking, but often with pleasing, results.

These may be secured in three ways:

(*a*). By arranging different tones in a series.

(*b*). By associating nearly related hues of a like tone.

(*c*) By viewing appropriate groupings of color by a colored light, as that from a stained window, which modifies them all in a particular direction.

COMPLEMENTARY COLORS.

Yellow has purple. Red has green. Blue has orange.

An important rule in mixing colors or pigments, is:

If the relative quantity of each color existing in the normal solar spectrum be not maintained, an uncompensated portion of one or more colors must remain, and the result may appear to be abnormal.

M. Chevreul, Superintendent of the Dyeing Department of the Gobelin Manufactory at Paris, has published one of the best books extant, on the subject of colors.

Chevreul's law for both hues and tones, is:

"When the eye sees at the same time two different contiguous colors, they will appear as dissimilar as possible, both in optical composition and in height of tone."

WHITE.—The effect of the contiguity of white is to deepen all hues, unless it be of a light yellow. With deep hues and tones the contrast of white is generally too violent.

BLACK.—Black accords well with any hue or tone except the deeper, as indigo or violet, which it renders apparently gray and faded.

Heavy gilded frames near too strong red or orange, is a violation of chromatic harmony.

Black and dark colors diminish, white and light tones enlarge an object.

All colors in the vicinity of the face influence the complexion.

Hues and tones of green improve a pale or blonde complexion.

Orange whitens the brunette complexion.

Light or pale tinted colors agree best with light, and deep or shaded colors with dark complexions.

Carpets, paper hangings, curtains, and furniture for rooms, should be of colors chosen with reference to their effects upon each other, and upon the complexions of the inmates.

The beauty of red flowers is enhanced by the neighborhood of green foliage.

When we look continuously on any color, as red, the color loses its vividness and beauty, because a color the opposite of red is excited in the eye and blends with it; but its complementary or any color near to this, as green, being now presented, the latter is at once improved, rendered

more pure and vivid by the acquired tendency of the eye to see that color. This is successive contrast; and it is shown that colors which will harmonize or affect the eye agreeably, or be improved by being viewed in succession, are opposites or complements, of each other. Colors nearly allied will be injured when thus beheld, and will affect the eye unfavorably.

We now see the great importance of color, and the absolute necessity of surrounding ourselves with properly arranged combinations of the various hues of the solar spectrum.

The effects of the influence of colors upon animals, is a subject well worthy of investigation by the student of natural history and by the medical profession. Walter Smith, the State Director of Art Education in Massachusetts, narrates the following incident:

"I was once informed of the utter misery inflicted unintentionally upon a man, whose life was as valuable to society as to himself, by the presence, in a sick-room, of a wall-paper which had certain prominent red spots upon it, appearing at intervals in the pattern. He was just past the climax of a typhoid fever, and had just arrived at that stage when the mind, not yet in full possession of the exhausted body, conjures up delusions—an almost inseparable stage in recovery from such a malady; and so critical a time that any relapse, through excitement or other causes, is almost certain to end fatally. Before the mind was capable of consecutive thought, like that of the child just strong enough to receive impressions only, the patient opened his eyes, to perceive on all sides a fiery red eye gazing on him from the walls of the room. That took the form of a delusion; and his semi-delirious efforts to hide these dreadful eyes from his sight, almost brought on a fatal relapse. Curtains were hung closely round him, though neither the nurses nor doctor were suspicious of the cause of his delusion. His convalescence was then rapid; he became sufficiently conscious to speak collectedly, the curtains were removed, and then the red balls tortured him in another form. Do what he would, he could not help counting them from floor to ceiling, from one wall to another; counting the figures mentally, adding and subtracting, without power to control himself, until he was almost in a worse fever than ever; at last he was sensible enough to beg to be taken to a room where there was no paper at all, and then found repose and comfort. The tortures he felt during that time were indescribable; and his grief was, that he had not strength enough nor clearness of head enough to explain what it was that afflicted him." In the same work he says: "A man could no more live in a room painted a glowing red color, than he could live in fire or stare at the noonday sun."

We are most of us familiar with the excited feeling provoked among turkeys on seeing a red dress; also on cattle and cows. Fish and frogs are caught with red rags or red feathers. The timid antelope of the prairies is lured within rifle-shot by a red handkerchief displayed from the end of the hunter's ram-rod. The wild bulls of the Spanish arena are provoked into fury by the displaying of the banners of the matadores. If, then, these animals are thus influenced so powerfully, how much more effect for good or evil must be produced on the human race, which possesses such a complex and delicate organization of mental and nervous structure.

A number of color sketches were exhibited by the speaker, and examined with interest by the members present.

THE donations for the month were announced as follows: From Geo. W. Campbell, Delaware, O., "Seventeenth Annual Report of the Ohio Horticultural Society;" from U. S. National Museum, "Proceedings of the U. S. National Museum," Vol. VII., Nos. 10 to 21; from D. L. James, "Smithsonian Report for 1861; Report of U. S. Coast Survey 1859–1860;" from N. H. Winchell, First, Tenth and Eleventh "Annual Reports of the Minnesota Geological and Natural History Survey;" from A. P. Butler, Columbia, S. C., "Resources, Population. Institutions and Industries of South Carolina;" from Natural History Society, Newport, R. I., "Proceedings for 1883–1884;" from U. S. Fish Commission, "Bulletin," Vol. IV., Nos. 17 to 22; from U. S. Geological Survey, Williams' "Mineral Resources of the United States;" from Chief Signal Officer, "Monthly Weather Review," July, 1884; from Zoological Garden, Specimens of *Lynx Canadensis*, *Erithizon dorsatus*, *Ibis rubra*, *Grus Americanus*, *Equus Burchellii*, *Cebus hypoleucus*, *Meles taxus* (male and female); from John Donahue, War Relics from the Battle-field of Seven Pines; from Bureau of Education, "Circulars of Information," Nos. 4 and 5, for 1884; from Ottawa Field Naturalists' Club, "Transactions," No. 5; from E. F. Bliss, Specimens of Minerals and Fossils; from Col. Jas. W. Abert, Ores from Colorado and New Mexico; from Mrs. Eli Kinney, Specimens of Minerals and Indian Relics—skull of Black Skimmer, etc.; from Robert Clarke, Mummy from Egypt; from Miss E. W. James, Young Horned Owl; from Wm. Nevins, Specimen of Banded Sandstone; from Chas. Dury, Hornet's Nest and Lamprey Eel; from A. E. Heighway, M. D., Conglomerate and Coal from Pennsylvania, and pamphlet on Anthracite Coal-fields.

MEETING OF NOVEMBER 4.

Vice-President Harper in the Chair.

The following paper was read and referred to the Publishing Committee:

ON PALM TREES.

By Jas. W. Abert.

While reading recently about the palm trees of South America, I met with the following statements:*

"In Chili, every year in early spring (which occurs in August) very many palm trees are cut down, and when the trunk is lying on the ground, the crown of leaves is cut off.

"The sap then immediately begins to flow from the upper end, and continues so doing for many months; it is necessary, however, that a thin slice should be shaved off from that end every morning, so as to expose a fresh surface.

"A good tree will give ninety gallons, and all this must have been contained in the vessels of the apparently dry trunk.

"It is said that the sap flows much more quickly on those days when the sun is powerful; and, likewise, that it is absolutely necessary to take care in cutting down the tree that it should fall with the head upward on the side of the hill; for if it falls down the slope (*i. e.*, with the butt end higher than the crown), scarcely any sap will flow, although in that position one would have thought that the action would have been aided, instead of checked, by the force of gravity. The sap is concentrated by boiling, and is then called treacle, which it very much resembles."

It has often occurred to me that the experiment might be tried with our sugar maples, in regard to the more bountiful flow of sap, when the position of the tree most conforms to its growing position in nature.

It seems strange that a tree, after its connection is severed with its roots, should still be capable of yielding ninety gallons of sap. If the tree in itself contained ninety gallons of sap, I should think that that amount could be obtained, whether the crown or the butt end lay uppermost. It would seem that the tree still continued to manufacture sap.

Palms are particularly interesting as conspicuous types of monocotyledonous and endogenous plants. They are trimerous; the dominant number which characterizes them is three, or multiples of three. Their leaves are pinnate, as in the cocoanut tree; or flabelliform, as in the palm-leaf

* Charles Darwin's "Naturalist's Voyage Round the World."

fan. I am familiar with three noted forms, which characterize their stems: The tree form, as in the palmetto of Florida; the vine form, as in the rattan; and the melon or pineapple form, as in the cycas.

There are one thousand species, and they are found in tropical and semitropical regions, where they are of universal utility to mankind. They furnish thatching for houses, brooms, baskets, hats, matting, cordage, twine, thread, writing material, oil, soap, candles, resin, wax, food of the nut or kernel and sago, milk, flour, salt, cement, cabbage, dragon-blood and paint, sap, tannin, yeast, palm-wine toddy, arrack, treacle, sugar, and many other things.

We will now speak of the "cycas" form. Some would say that it resembles a turnip; but, in truth, it merely looks like it, for the turnip is dicotylodonous and exogenous; has netted-veined leaves, a tap-root, and belongs to a class of vegetation possessing hardwood stems, with concentric annular rings of growth, and a true bark, composed of several coatings.

Palm plants do possess intimate analogies to the common onion, which is monocotyledonous, endogenous, has parallel-veined leaves; no true bark; no consecutive rings of hard, woody matter; no radiating medullary rays.

In Florida we have the saw palmetto (*Sabal Serrulato*), the prickly palmetto (*S. hystrix*), the cabbage tree palmetto (*Chamærops palmetto*), the royal palm (*Oredoxa regia*), the cocoanut tree (*Cocos nucifera*), the dwarf palmetto (*Sabal Adansonii*), and the date palm (*Phœnix dactylifera*).

Mr. D. L. James informs me that the date palm is found growing at St. Augustine, Fla.

The saw grass palmetto possesses a trunk about the size of a fence rail, which lies prone upon the ground, so that traveling in a wagon over a new road in Florida nearly jolts the life out of you.

The rattan is of great use in chair-making—comes mostly from China. It possesses long, slender stems, with hard, glossy, silicious epidermis. The leaves are pinnate; grow with some distance between the nodes, often terminate in tendrils. The slender stems, which are sometimes 500 feet long, cling to neighboring trees. These stems look like cordage, and are used by the people of India in catching elephants.

This plant forms the connecting link between the gramineous plants and the palms.

The royal palm (*Oredoxa regia*) I found growing luxuriantly at Cape Sable, the extreme southern point of Florida. It has pinnate leaves, and the trunk is from 60 to 100 feet in height. The wood, when dressed and varnished, is often made into billiard cues and walking canes. Some of the cycas-

formed palms, as well as the tree-formed, furnish the sago, which comes from the isles of the East Indian Archipelago. The interior of the plant is filled with pith, cellular tissue. The vegetable nutriment is provided for the maturing of the fruit; for as soon as the fruit begins to form, the store of fecula disappears, leaving quite a hollow stem. This fecula is formed into round, transparent, bead-like grains by an artificial process, and comes into commerce as pearl sago, granulated sago, and brown sago.

The cocoanut tree (*Cocos nucifera*) is found as far north as Jupiter Inlet, near north latitude 27°, and I have collected the nuts at Key Biscayne, Florida, in north latitude 26°. It is maritime in its habitat. The trunk is from 50 to 80 feet in height, and generally slightly inclined; the pinnate leaves from 10 to 15 feet in length. There are from 10 to 12 nuts in a bunch, which grow close to the crown of the tree, just underneath the leaves. There are from 8 to 12 bunches produced on a single tree, and the nuts are ripening every month in the year. Those nuts nearest the tree ripen first and drop off. The nut is inclosed in a long, boat-shaped, three-sided husk, which has a smooth, yellow exterior. Often the ripened nuts fall into the sea, and float away to distant shores. If, while floating, the nut commences to germinate, the plumule pushes its way to the far end of coir fibre; it makes its side of the nut heavier, so that the shoot floats under water, where, being shaded and cool, the process of germination is retarded until the nut may chance to be cast ashore, where it can vegetate and become a magnificent tree, furnishing food and shelter.

The white, solid cone at the apex, when cut transversely into thin slices, is so much like "cold slaw," that few persons would perceive any difference either in appearance or taste.

When our ships visit the southern isles of the Pacific, the little Indian children, of three years of age only, impelled by a spirit of curiosity and adventure, swim off to the ships, buoyed up with one hand supported on an unhusked cocoanut.

The cocoanut may have furnished the means to discover America by emigration from the Polynesian Islands. The bread fruit and the cocoanut furnish food that would keep for a voyage. It is well canned by Nature, and the calabash furnishes a natural cask to preserve a supply of fresh water. Thus equipped for a voyage, the South Sea Islanders may have anticipated Columbus, and Aztecs and Mound Builders owe their appearance in America to the assistance furnished them by the cocoanut palm.

In the cocoanut tree, the flowers come out in clusters round the summit

of the trunk, enclosed in a spathe or sheath. The staminate flowers are nearer the top, and the pistillate nearer the bottom of the same spadix, and both are sessile. The staminate flowers have a three-leaved calyx, a three-petaled corolla, and six stamens. The pistillate flowers have three sepals and three petals, with three sessile stigmas. The flowers are of a pale yellow color.

The drupes are fibrous; there are from 12 to 20 in a bunch. They are at first green, then orange, then brown, when mature. The nut is familiar to all. It has three round scars at the base, out of one of which the embryo plant shoots forth.

The vernation of the cocoanut tree can be best described as consisting of a great number of cones formed around a common axis and fitted compactly one on top of the other, beginning with one of extreme minuteness, which is situated exactly at the apex of the trunk of the tree.

The phyllotaxy of the palm plants is typified in a fossil belonging to the carboniferous age, called *Archimedes*, and in living mollusks by the *Turritella* and *Scalaria.* If you conceive of a vertical axis, with an inclined line touching it, and gradually ascending with a uniform motion, the free end revolving in space about the vertical axis, the line thus moving will generate a helicoidal surface, and the point, or moving end of the line, will generate a helix. Upon such a helix the leaves on the trunk of a palm tree are arranged.

This spiral formation exercises a dominant control in the formation of fish, birds and animals.

In many monocotyledons, as in the maize, in all grasses, in spider-wort, bell-wort and iris, the numerical symbol is the fraction $\frac{1}{2}$, in which the numerator expresses the number of turns around the stem for completing one cycle, or set of leaves, while the denominator expresses the number of leaves in the cycle.

The general form of the palm carries us back to the fern trees of the carboniferous age, which Caruthers suggests as foreshadowing the monocotyledons, and also the dicotyledons, "and that they are probably the progenitors, not only of the tree ferns of the present day, but also of the palms and the foliferous exogens."

Le Conte's drawing of an ideal section of the Lepidodendron, displays distinctly the manner of growth of the vascular bundles from the central axis of the tree toward the base of the leaf petioles on the periphery. (See Figure 1.)

a—pith.
b—vascular cylinder.
c—bark.
d—rind.
e—base of petioles.
f—vascular threads.

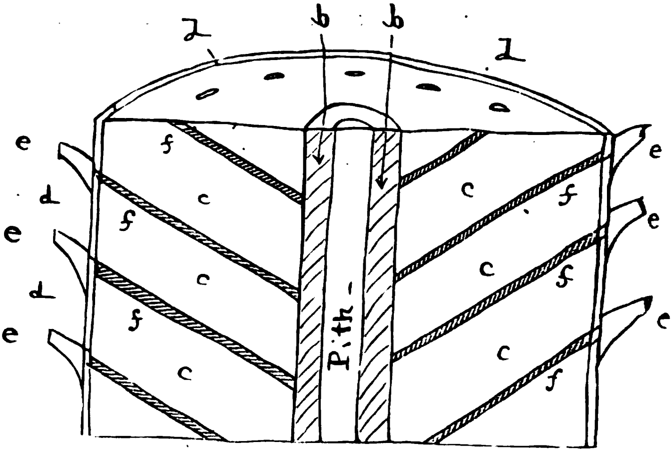
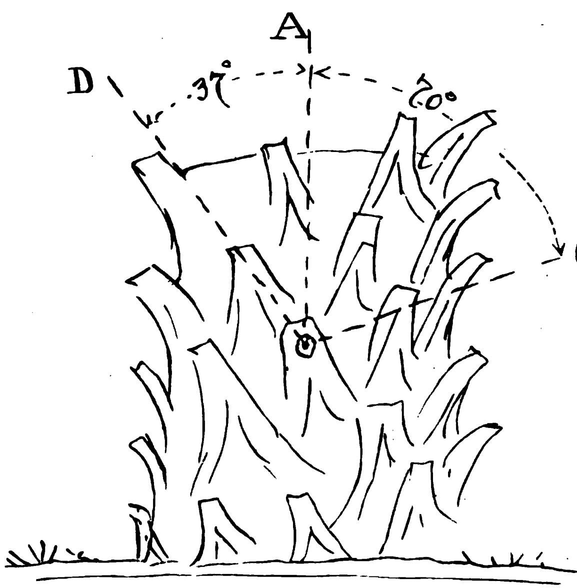


Figure 1.—IDEAL SECTION OF LEPIDODENDRON.—After Joseph LeConte.

In a drawing of the same kind of tree by J. D. Dana, the phyllotaxy is beautifully shown (in the Halonia pulchella). The helix ascending



A B C—an angle of 70°.
A B D—an angle of 37°.

Figure 2.—CHAMÆROPS PALMETTO.—J. W. A.

The ascending helix of leaf growth makes an angle of 70° with the axis of the trunk. The transverse helix makes an angle of 37°.

toward the right, makes an angle with the axis of the stem of 38°; the helix ascending toward the left, an angle of 25° with the central axis.

In the palmetto, the angle ABC, is 70°, the angle ABD, 37°. (See Figure 2.)

Desfontaines showed that the vascular bundles which run to the leaves, come from the centre of the stem, in the date palm, and in monocotyledons. Decandolle adopted this theory, while Molenhauer declared positively against its being a truthful conclusion.

One thing is certain; we find the leaf-bud starting at the very apex of the central axis of the cylindrical stem, and the matured leaf finds its final resting place on the exterior of the trunk, and on the ascending helix—the vascular fibres which run to the petiole of the leaf must necessarily be bent from the centre of the cylinder to the circumference, in order to adapt themselves to the movements of the growing leaf. Von Mohl states that the bundles of vascular tissue start from the periphery of the trunk, incline very gradually toward the central axis, then, by a marked curvature turn outward—toward the leaf stems. Thus it occurs in tracing the bundles upward.

"The vital or milk vessels for sap in the vascular bundles run from the periphery toward the central axis of the stem, thence to the leaf. The 'proper vessels' convey clear sap, and lie isolated in the interspaces of the cellular tissue, in the vicinity of the vascular bundles in the pith. The milk vessels, or vital sap vessels, exist independently, each set of vessels conveying wholly different sap."

Speaking of the two kind of vessels for conveying sap in monocotyledons, Von Mohl says, "These vessels (the milk vessels) then, are distinguished from the proper vessels (vasa propria) in the vascular bundles, by their different situation and by the red color of their contents, which color is never assumed by the sap of the proper vessels.

"The proper vessels in the vascular bundles of Sagittaria are no less clearly distinguished from the milk vessels lying scattered in the parenchyma of the peduncle and petiole, for the latter convey milky sap; the former very transparent sap."

I can not conclude without inviting the attention of our citizens to the necessity of a Botanic Garden in Cincinnati. I have not time to dilate upon its vital importance in connection with the pursuits of medicine, agriculture, horticulture, dyeing and weaving—or in inventing patterns for textile fabrics, and for the decorative arts.

The Moors, who excelled in their colors and arabesques, established magnificent gardens on their first entry into Spain.

In France, at Paris, plants were cultivated to serve as patterns to Court embroiderers.

In Europe generally, so universally acknowledged is the value of botanic gardens for the culture and industrial education of the people, that scarce a city of any size, is without its public garden. Even the antagonistic climates of St. Petersburg, Moscow, Warsaw and Finland have been noted for their botanic gardens. We should have them as adjuncts to the Zoölogical Garden and the Cincinnati Museum.

That great and noble patriot, Washington, shortly previous to his death, wrote to Congress recommending the establishment of a university at the Seat of Government; and in this document he said: "I conceive that a botanical garden would be a good appendage to a university."

Mr. George P. Handy was proposed for regular membership.

Prof. A. D. Morrill was elected a regular member.

The Secretary stated that the communication of Mr. Charles Dury, received at a late meeting of the Society and referred to the Executive Board, had been received by the Board and a committee appointed. The Board of Exposition Commissioners had resolved to donate a large collection of Colorado minerals to the Society, and they would soon be in the museum.

The Custodian stated that the collection consisted of a large mass of material, chiefly ores from Colorado, and would be examined and sorted as soon as possible.

The donations for the month were announced as follows: From D. L. James, Reports of Commissioner of Indian Affairs, 1863–1869; seeds of *Anemone Virginiana*, *Gleditschia triacanthos;* from Thomas Paxton, *Bubo Virginianus;* from W. W. Thompson, Proceedings of American Association for the Advancement of Science, 1883; from J. Ralston Skinner, Stevens' Flint Chips; from Chief Signal Officer, Monthly Weather Review August, 1884; from S. T. Carley, three species of shells; from Central Ohio Scientifie Association, Proceedings, Vol. I., Part 2; from U. S. Naval Observatory, Vol. XXVII. Astronomical and Meteorological Observations; from Mrs. May and Miss Virginia Bowers, War Club from Sandwich Islands; from G. Kjerulf, Pods of Cotton; from U. S. Fish Commission, Bulletin, Vol. IV., Nos. 23 to 29; from Nelson Perry, Specimens Native Silver and Gold from Mexico; from J. B. Peppers, specimen of Spider; from Cincinnati Exposition Commissioners, Specimens of Gold, Silver and Copper Ores, etc., from Colorado, Arizona and New Mexico.

TUESDAY, *December* 2, 1884.

Vice President Harper in the chair. Twelve members present.

The following paper was read and referred to the Publishing Committee:

THE AZTEC CALENDAR STONE.

By JAMES W. ABERT.

Many years ago, when just from that most excellent school, the U. S. Academy at West Point, I was looking over an old portfolio, and there found two engravings which attracted my notice especially. The first was marked in Spanish, "Reloj solar meridional que usaban los antiguos Mexicanos," and represented the horizontal projections of the construction proper for a solar dial. The second was marked, "Lamina III.," and was a drawing of the famous Aztec Calendar Stone, a perpetual calendar used by the people of the great Montezuma, whom Cortez conquered, and whose historical and ethnological records the Spaniards so ruthlessly destroyed in the flames, incensed by a wild enthusiasm to obliterate all traces of heathen idolatry and the cruel customs and bloody deeds of human sacrifices.

With great care I have always preserved these random drawings, and you can judge of my delight when, a few weeks since (the 10th of November), I was rewarded for my care by finding in a rare old Spanish book a complete description and explanation of this identical engraving of the Aztec Calendar Stone. The book is by Don Antonio de Leon y Gama, published in Mexico in 1792. The author proves to be an astronomer of note, and a man familiar with the ancient language of the Aztecs, as well as one deeply skilled and interested in the ancient lore of the Mexicans. It was by the means of excavations, prosecuted at the suggestion of Gama, that many valuable memorials, together with the great stone, were discovered on the 13th of August, 1790—a memorable day, as it was the anniversary of the very day on which Cortez took possession of the City of Mexico, in the year 1521.

Gama's works have been quoted by many of the most skilled savans since his day, as Humboldt, Lord Kingsborough, Gallatin, and the latter says: "Since all other systems are proved to be erroneous, and that of Gama is alone consistent with itself and sustained by the proofs which have been stated, it has in its favor the highest degree of probability of which the case is susceptible."

The Calendar Stone (Plate X) was discovered buried under ground in the great plaza, or square, of the City of Mexico, near the site of the temple

of the Aztecs. Though somewhat mutilated, it is almost a perfect square in form, and consists of a circular cylinder, raised in relief of eleven inches beyond the remaining surface of the stone, which is four and a half Spanish yards in width, one yard (vara*) in thickness, and, according to Lord Kingsborough, weighs fifty tons.

In the office of the Topeka & Santa Fe Railroad Company, No. 159 Walnut Street, there is a large photographic copy of this stone, but the carvings have been much defaced since Gama first saw it, and, most fortunately, had accurate drawings made of its marvelous hieroglyphics.

The surface of the stone is covered with concentric circles, inclosing figures, which refer to the several motions of the sun, and to some of the Mexican festivals and ceremonials which were celebrated at the periods included between the vernal and autumnal equinoxes.

It has been ascertained that this stone was constructed and placed in a Mexican temple but a few years previous to the conquest, and during the reign of the last of the Montezumas.

The great Calendar Stone now stands fixed in the wall of the Grand Cathedral of Mexico.

The principal figure represents a human face, with the tongue hanging out, inclosed by a circle seven-eighths varas in diameter. The circle exterior to this is one and five-eighths varas in diameter, and it incloses four square-framed hieroglyphics, which refer to the four seasons, and to the legends of the sun's four destructions.

Around the principal central figure of the sun and the seasons, the next circles inclose the symbols of the twenty (20) days of the month, each of which has a special symbol and a special name, as follows:

1. Cipactli—sea monster.
2. Ehecatl—wind.
3. Calli—house.
4. Cuetzpalin—lizard.
5. Cohuatl—serpent.
6. Miquiztli—death.
7. Mazatl—deer.
8. Tochtli—rabbit.
9. Atl—water.
10. Itzcuintli—dog.
11. Ozomatli—ape.
12. Malinalli—grass.
13. Acatl—reeds.
14. Ocelotl—tiger.
15. Quauhtli—eagle.
16. Cozcaquauhtli—vulture.
17. Ollin—sun's movements.
18. Tecpatl—flint.
19. Quiahuitl—rain.
20. Xochtli—flower.

These symbols are arranged in such order of sequence that, beginning at the upper rim of the circle, you move around successively to the left, as is

*The vara is equal to 32.9 inches.

indicated by the numbers, ranging from 1 to 20. The next circles exterior to those containing the days of the month, you find fifty-two small squares, but only forty are sculptured, as three are considered to be concealed beneath each of the four chief cardinal points, which would make fifty-two squares in all;* and each of these fifty-two squares contains five figures for days, which, Gama states, as representing the period of 260 days, twenty of the first, or moon reckoning "trecenas," or thirteen days. $13 \times 20 = 260$.

The whole circle is divided into eight angular points R, which designate the eight principal times of the day. The intervals between these are again divided by small circular symbols, designated by the letters L, which designate the hours of the night. At the top of the stone is the symbol of a bunch of reeds and thirteen roundlets, to designate "13 Acatl," which shows that this stone applies to that year.

Mr. Gallatin conjectures that this symbol must have been solely for astronomical purposes, while Gama presumes that it was on account of its being the twenty-sixth year of the circle, equally removed from the beginning and the end. It certainly was not intended to designate the year that the stone was brought to Mexico, for no year of "13 Acatl" occurred during the reign of Montezuma.

The smaller interior image, as we have already stated, is the image of the sun and the four parallelogrammes, A, B, C, D, containing respectively the hieroglyphics of the days 4 Ocelotl, 4 Ehecatl, 4 Quiahuitl and 4 Atl. The lateral figures, E and F, according to Gama, represent two great astrologers, "Cipactonal" and "Oxomoco," husband and wife, who were represented in the shape of eagles and owls, and who are said to have invented this stone and caused it to be sculptured.

This representation of the sun, with the accompanying parallelogrammes, is named "Ollin" (according to Gama). The Mexicans believed that the sun died four times, and that the one that now shines is the fifth, also doomed to destruction. From the first creation, the first age and the first sun endured for 676 years, or thirteen cycles, when the crops failed, and men were devoured by tigers. This took place in the year 1 Acatl, and on the day 4 Ocelotl, when the sun died. This destruction lasted thirteen years. The second age and sun lasted 364 years, or seven cycles, and ended in the year 1 Tecpatl, on the day 4 Ehecatl, when the destruction was caused by high winds and hurricanes, and some men were changed into monkeys. The third age lasted 312 years,

*They had 52 years in their cycle.

six cycles; when, in the year 1 Tecpatl, on the day 4 Quiahuitl, the destruction was caused by fire and earthquakes, and men were changed into owls. The fourth age lasted 52 years, when, in the year 1 Calli, on the day 4 Atl, the world was destroyed by the flood, and men were changed into fishes. After all these terrible convulsions of Nature had subsided, the gods created the existing fifth sun and fifth moon. The four eras of destruction are precisely those symbolized in the four parallelogrammes, A, B, C, D.

From the Mexican Almanac, according to Gama, we find that* the letter "A" designates 4 Ocelotl, the 17th of May; the letter "C," 4 Quiahuitl, the 27th of July. These are the dates of the sun's zenith transit at the City of Mexico.

"H" designates 10 Ollin, the 22d of September; "N," 1 Quiahuitl, the 22d of March, and "M," 2 Ozomatli, the 22d of June.

And Mr. Gallatin says: "We have on this stone the dates of the five principal positions of the sun from the vernal to the autumnal equinox. Three of these, the two transits of the sun by the zenith and the autumnal equinox, are Mexican days, on which these phenomena occurred in the first year of the cycle (1 Tochtli); and the two others, the vernal equinox and the summer solstice, are the Mexican days on which these two phenomena occurred in the year 13 Acatl.

"These dates are not founded on conjecture, nor derived from Indian paintings no longer to be found, or of a date subsequent to the conquest, or from the uncertain indications given by the Indian writers who wrote with our alphabet either in Spanish or Mexican language. They are positive facts, engraved by the Indian priests before the conquest, on a stone monument of indubitable authenticity."

Mr. Gallatin says that it is highly probable that these mythological representations are connected with celestial phenomena. "And it is found accordingly that the days designated in the parallelograms A and C as 4 Ocelotl and 4 Quiahuitl, correspond respectively to the 17th of May and the 27th of July, and these two days are those of the transit of the sun by the zenith of the City of Mexico, which is situated in north latitude, 19°, 25′, 57″, and in the longitude, 101°, 25′, 20,″ west of Paris."

Every date inserted in the Calendar Stone refers to the period from the vernal to the autumnal equinox, and the days agree with those that all astronomers now assign to them. And Gama concludes that a stone some-

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* See Trans. Am. Ethnological Society, Vol. I, p. 98, and Table C. The dates are according to our calendar.

what similar to this one, but representing the other half of the ecliptic, is yet to be found.

There are certain holes near the edges of the outer cylinder of the Calendar Stone. These holes are drilled so as to be perpendicular to the face of the stone, and are designated by the letters X, Z, and S, V, P, P, and Q, Q, which correspond nearly with the subdivisions of the circle into eight parts, designated by the letters L, L.

The stone was placed in a vertical position, parallel to the prime vertical plane (*i. e.*, due east and west), and facing to the south, and Gama states that they fixed two gnomons of equal length into the holes, X and Z; also two of equal length, but longer than the first two, at S and Y; the difference in the two sets of gnomons was made equal to that which exists between the zenith of Mexico and the Tropic of Cancer. Threads or fine cords were stretched through the ends of each set of gnomons, hence, the shadow of the upper thread (on the day of "ce Ozomatli" in the year 13 Acatl), or on the 22d of June. When the sun attains its highest declination, the shadows of these threads will coincide in a due east and west line upon the face of a horizontal plane, and the angle formed by a plane containing the threads, with the equatorial plane minus the angle P E Z, will give an angle equal to the latitude of Mexico.. (Fig. 1.)

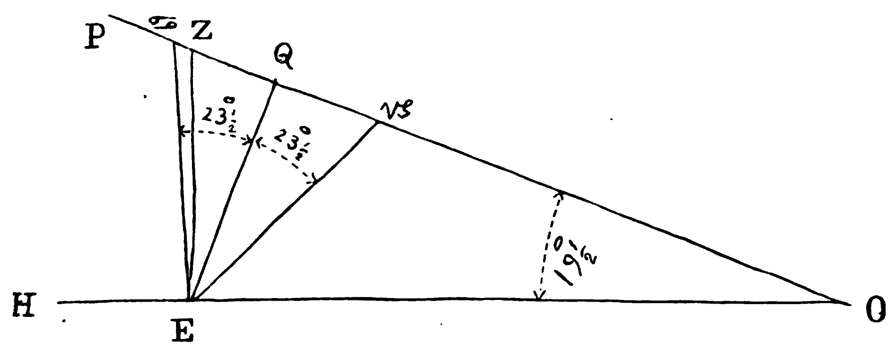

Figure 1.—Diagram showing sun in the zenith on May 17th and July 27th.

Or, the gnomons may have been arranged of such relative lengths, that, at the equinoxes, the plane of their shadows would coincide with the equatorial plane, and then the angle made with the face of the Calendar Stone (*i. e.*, Q E Z), would give the latitude of Mexico.

The other four holes, equally distant, are P, P, and Q, Q, which answer the purpose of holding four gnomons of equal length; through the ends of each pair threads were stretched horizontally, the thread P, P, over the thread Q, Q, and in the same vertical plane, at right angles to the merid-

ian, and passing through the zenith. The coincidence of the shadows of the two threads would make known the day when the sun was in the zenith, in going from the equinoctial to the Tropic of Cancer, and again, when the sun returned to the equinoctial; for in those two days the shadow of the upper thread would exactly coincide with that of the lower, precisely at the moment of mid-day. This occurs on the 16th or 17th of May (the day *Naui Ocelotl*) when the sun passes first through the zenith, and the second time, 26th or 27th of July, (the day 10 Cohuatl.)

By means of the shadow of the upper thread, P, P, they knew exactly the day of the "Trecena," which was dedicated to the sun, on which occasion they celebrated grand festivals, which were left to the charge of the priest or principal minister (*Ep cou qua cuilt zin*), the master of ceremonies. They well knew that at the end of one of their cycles of fifty-two years the civil year had receded thirteen days, and in order to equalize it to the solar year, they intercalated those days. It was easy for them to ascertain, in any year, how many of these thirteen days they must take into their reckoning, in order to verify the precise time of the equinoxes, and solstices, and transits of the sun through the zenith.

This stone also served as a solar dial, and in addition to its marking noon by the vertical and parallel shadows east by the gnomons, X and Z, they also pointed out the hours of nine in the morning and of three in the afternoon; times which they particularly observed for their rites and ceremonials. The hour of nine was marked by the shadows of the gnomon Z when it passed along the left edge "z" of the frame of the "Ocelotl," and through the middle of the circlet "g" in the circle of the sun, and along the right side "s" of the frame of Quiahuitl, and coinciding with the lower gnomon S. In the like manner the shadow passing along the right side of the frame of Ehecatl at "s," and through the circlet "y," and through the left side at "h" of the frame which includes the symbol "Atl," and thence continued through gnomon Y, in the lower part of stone, this shadow would point out the hour of three in the afternoon.

The Mexicans also took account of the times of the night, especially of the hours of nine in the evening and three in the morning; which hours they knew from the rising and culmination of certain stars, according to the time of the year, as is ascertained from what has been stated by both Torquemada and D. Hernandez. They expressly state the hours in which incense was daily burned to the sun, and sacrifices offered up.

This stone was destined for other purposes, in addition to those which we have stated, but as little has been narrated on these matters in the histories, we could not find out very much about them. It has been ascer-

tained that by its means they regulated the festivals of the moon, and by its means they determined the days of "Tonalamatl,"* and arranged the days of their "Second Calendar" (the moon calendar) in sets of thirteen, corresponding to its phases, by night and day, under the title of *sleeping* and *waking* of the moon; which intervals they designated by the word "Metztli," a name appropriated to the moon; and to the period of the 260 days, the name of "Metztla, pohualiztli," or reckoning of the moon.

By the means of the gnomons and shadows of the threads, they made observations in regard to the rising, setting, and culminations of the moon; thus they obtained minute knowledge of the movements of the moon, to which they offered the same veneration and worship as to the sun, and to which they had dedicated a beautiful temple named "Tecuiccizcalco." It was built of shells.

The magnitude of this stone, and the art necessary to transport it from the locality or the quarry to the place where it was put into position have filled many persons with astonishment, and there has been much discussion in regard to its weight. In Lord Kingsborough's works the weight is stated at fifty tons. In moving it they supplied the want of cars and other wheeled vehicles by loose cylinders of wood, by the means of which they moved and actually did transport for considerable distances bodies of great weight and volume, simply by changing the position of the cylinders or rollers.

It may appear astonishing, nay, almost incredible to some persons, that what we call semi-civilized nations, such as the Egyptians, Peruvians, Hindoos and Mexicans, should possess such a marvelous amount of astronomical knowledge, and of such minute exactitude, in regard to the movements of the sun, the moon, and the stars, together with the inclination of the earth's axis and the construction of dials; truly, it seems most marvelous that all this should be attained without the aid of such refined astronomical instruments as we now possess. But the great point of distinction to be noted is the freedom from the necessity of this kind of knowledge among nomadic people, and the absolute necessity of possessing it among all those who build permanent towns, who erect solid structures, which give a fixed and permanent basis from which to begin observations. The foundations for observations once laid, the first steps are taken which serve to traverse the gulf between ignorance and knowledge, and the progressive improvement is made—surely it may be, certainly it must be.

*Tonalamatl means the table of the Commandments of God or of the sun.

To know how much may be achieved with the simplest instrumental appliances, we need but read the description of the Portable Dial, of Ferguson, given in the Encyclopædia Britannica, where you will see that by means of a pasteboard card and a simple plumb-line—which by the way is one of the most exact lines of reference the most refined astronomers can obtain—with these simple means you can work out five valuable astronomical problems.

As, I. To find the hour of the day.
II. To find the time of the sun's rising and setting.
III. To find the sun's declination.
IV. To find what day the sun enters a "Sign."
V. To find the meridian altitude of the sun.

In order to demonstrate what scientific skill the Mexicans displayed in order to make accurate observations, on the celestial bodies, I herewith call your attention to the drawing of an astronomical observatory, which you will find in Lord Kingsborough's works, No. 72, Plate 24, Vol., IV, Wm. Dupaix's collection. (Fig. 2.)

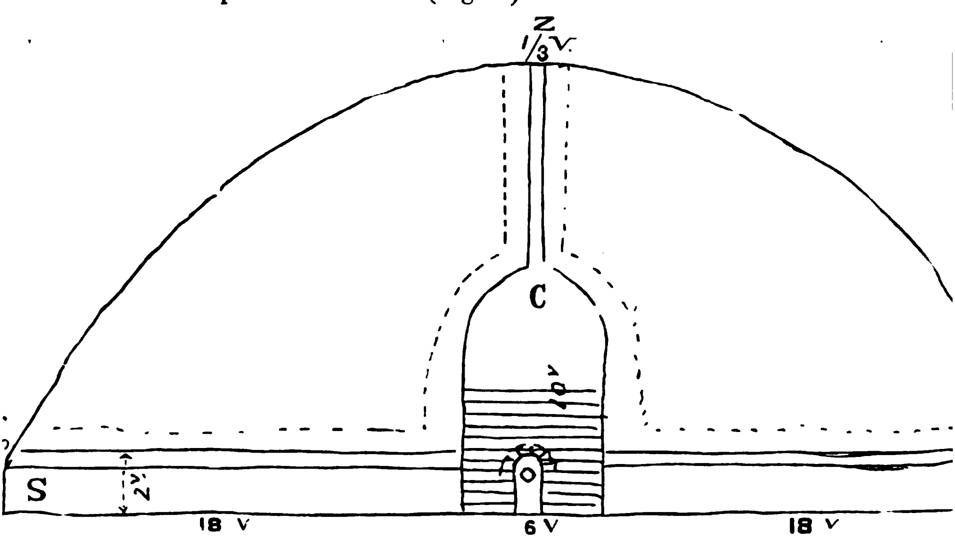

Figure 2.—MEXICAN OBSERVATORY.—From Lord Kingsborough.

Main chamber square. S-N—Tubular passage running north and south O—Passage running east and west. C-Z—Vertical passage. V—Signifies a *vara* (32.9 inches).

A rectangular chamber is seen, six yards wide and ten yards high, intersected by two passages, at right angles and oriented; one six feet high by three feet wide, the other cylindrical, and only one foot in diameter, its top six feet above the floor, and also due north and south, *i. e.*, in the

plane of the meridian. By the means of this tubular passage they could take observations upon the culminations of the sun and moon, by using a mirror of mica or obsidian, to get the reflection of the rays to be visible through the long narrow aperture. The passage at right angles was used to obtain entrance or exit to the main chamber, and doubtless it served to obtain observations on the sun at the vernal and autumnal equinoxes; and there is seen also a tubular vertical passage of one foot in diameter, which served to observe the two zenith transits of the sun.

It is worthy of especial notice that the arched roof of the main chamber is a groined arch, springing from the top of four walls of a square chamber. The arching of the horizontal passages, of the vaulted roof of chamber, and the wall of the vertical aperture for zenith observations, are all of some kind of strong cement, one yard in thickness. The lower half of the meridian passage and the walls of the chamber are made of dressed stone—a true stone arch is seen over the doorway at the entrance of the main chamber. The whole structure presents the appearance of a simple mound of earth, 51 feet high and 126 feet in diameter.

The horizontal passage being in the plane of the meridian, could not be well used, except by the aid of reflecting mirrors of mica or obsidian, by which means the movement of the sun to its maximum and minimum declination could be followed, and the light transmitted through the long, narrow, cylindrical aperture, and every meridian passage throughout the year could be observed. Dupaix speaks of this as "either a temple or mansion of the dead, for it might have served both purposes." You will also find a curious dome structure, with a vertical aperture, somewhat resembling the structure just described in this same work of Lord Kingsborough. (See Figure 34, Plate 16, Vol. IV., and description in Vol. VI., p. 420.)

While speaking of this singular building in which the true arch is seen above the doorways, I would call attention to some ancient bridges described by Dupaix. (See Lord Kingsborough, Vol. VI., p. 466.) In the province of Tlalcala are two stone bridges, one near Los Reyes, built of stone and cemented with mortar. "It has a sort of arch, which forms an obtuse angle, springing from two side walls or buttresses." It is seven feet high, seven feet broad, and has a width of forty-two feet. The other bridge, which is not far away, is one hundred and two feet long, thirty-six feet broad; its perpendicular elevation is sixty feet. Both bridges have four obelisks each, at their four angles, and are guarded by parapet walls. This "sort of arch" consists of large stones, about fourteen feet long, placed so that the ends abut against each other after

the manner of rafters; the thrusting weight is transmitted to the abutments; all that was wanting was the keystone to complete the perfect arch. (Fig. 3.)

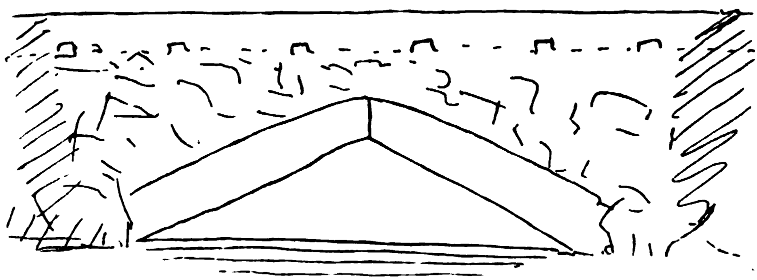

Figure 3,—STONE BRIDGE.—From Lord Kingborough's Mexican Antiquities.

The wheel sculptured stones are numerous. They all agree with the Calendar Stone, in having eight pointed rays and eight blunted rays, dividing the circumference into sixteen equal parts.

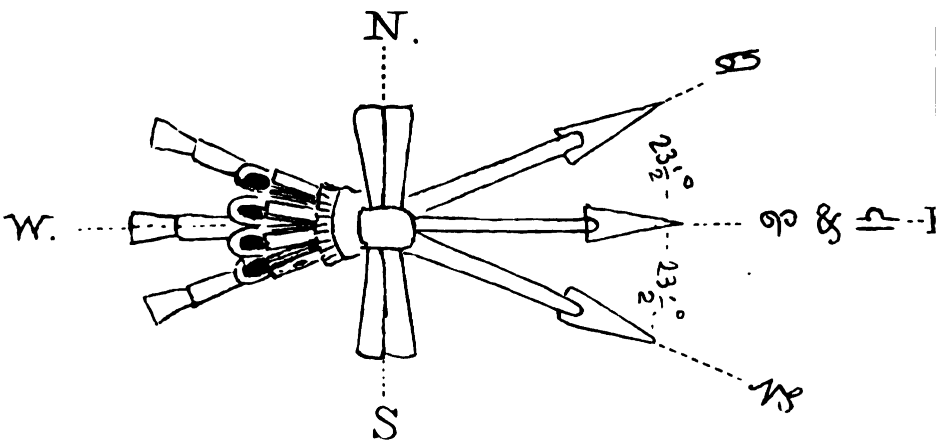

Figure 4.—The three arrows of Chapultepec. J. W. A.

There were also some very interesting stones found on the hill of Chapultepec, one of which had three arrows engraved upon its horizontal surface. The points of the arrows directed toward the east marked out the two solstitial points, and the middle arrow, which bisected the angle between the two others, pointed due east, to the equinoxial point; at the common point of intersection of the three arrows, there was a band which tied them together. There was observed a small line crossing its centre, and two

other stones were placed in a direction, one directly north, the other directly south, of this mark. The two had holes drilled in them to contain rods, to which a cord could be attached to serve for a meridian line, and and the three stones were so arranged that the shadow of this line would fall upon the mark of the band of the arrows at the instant of midday. (See Gama, p. 110.) The symbol of the three arrows is of frequent occurrence in Kingsborough's work. (Fig. 4.)

Having now given you some idea of the purposes of the Aztec Calendar Stone, I must here state that, in order to comprehend fully how to use it, you must understand their calendar and methods of reckoning time.

The Mexicans possessed two kinds of calendars, viz.: their civil calendar, or reckoning by the sun, and their religious calendar, or reckoning by the moon. Here we have a table of the Mexican half-century of fifty-two years:

1	TLALPILLI.	YEAR.	2	TLALPILLI.	YEAR.	3	TLALPILLI.	YEAR.	4	TLALPILLI.	YEAR
1	Tochtli,	1	1	Acatl,	14	1	Tecpatl,	27	1	Calli,	40
2	Acatl,	2	2	Tecpatl,	15	2	Calli,	28	2	Tochtli	41
3	Tecpatl,	3	3	Calli,	16	3	Tochtli,	29	3	Acatl,	42
4	Calli,	4	4	Tochtli,	17	4	Acatl,	30	4	Tecpatl,	43
5	Tochtli,	5	5	Acatl,	18	5	Tecpatl,	31	5	Calli,	44
6	Acatl,	6	6	Tecpatl,	19	6	Calli,	32	6	Tochtli,	45
7	Tecpatl,	7	7	Calli,	20	7	Tochtli	33	7	Acatl,	46
8	Calli,	8	8	Tochtli,	21	8	Acatl,	34	8	Tecpatl,	47
9	Tochtli,	9	9	Acatl,	22	9	Tecpatl	35	9	Calli,	48
10	Acatl,	10	10	Tecpatl	23	10	Calli,	36	10	Tochtli,	49
11	Tecpatl,	11	11	Calli,	24	11	Tochtli,	37	11	Acatl,	50
12	Calli,	12	12	Tochtli,	25	12	Acatl,	38	12	Tecpatl,	51
13	Tochtli.	13	13	Acatl,	26	13	Tecpatl.	39	13	Calli,	52

In this they use four symbols only, but since 4 and 13 are incommensurable, no confusing repetition could occur until fifty-two years have elapsed.

The religious calendar, or reckoning by the moon, was used by the priests to regulate their ritualistic festivals. It consisted of "trecena"—periods of thirteen days—and twenty hieroglyphics for the days of the months, by which a cycle of 260 days was formed ($13 \times 20 = 260$). This period formed the religious year. Seventy-three periods of 260 days amounts to 18,980 days, the precise number of days in their half century of 52 years.

The civil year contained eighteen months of twenty days, divided into four weeks or periods of five days each. Every fifth day was a grand market day and a day for festivals.

As the religious year of 260 days required 105 additional days to equalize it with the civil year, the Aztecs used a third series, in order that the

repetition of the same numbers should be capable of being distinguished. This third series consisted of nine hieroglyphics called "Lords of the Night." The use of this new set of symbols would prevent them from falling into any confusion, caused by the repetition of the same terms for the additional 105 days which must be added to this period of 260 days in order to complete the religious year, or "moon year," and make it commensurate with the civil year, or "sun year."

The Mayas had calendars composed in the same manner as the Mexicans, for their year was made up of eighteen months of twenty days each, with the addition of five epagamenon, and their cycle of 52 years was composed of four differently named years, arranged in sets of thirteen, and four times repeated. "A cycle of 52 years was thus obtained in a manner almost identical with that of the Aztecs, Tarascos and other nations." (See Dan'l G. Brinton.)

One is struck with wonder in considering the high attainments these people had made in astronomical knowledge. Where they originally obtained it, is as yet a mystery. But one thing seems certain, that all the civilization of our American Indians must have originated at the great focus of Indian civilization.

"It is believed by Baron Humboldt, and by others, that in the Navajoes and Moquis, we see the descendants of the same race of Indians which Cortez and the Spanish conquerors found in Mexico in a semi-civilized state. The whiteness of their skins; their knowledge of useful arts and agriculture, and the mechanical skill exhibited in their edifices at the present day bear a striking analogy to the Mexican people at the period of the conquest; and, as Humboldt says, 'appear to announce traces of the cultivation of the ancient Mexicans.' . . . We are tempted to believe that, at the period of the migration of the Toltecs, the Acolhues and the Aztecs, several tribes separated from the great mass of the people to establish themselves in these northern regions."

Then from the Aztecs this civilization was spread abroad by the intercourse of trading, and also by means of couriers, or runners, who answer to our mail carriers.

The City of Mexico constituted the grand centre, from which irradiated the best and the highest culture which could be obtained by any of our Indians, and when we desire to investigate any of the subjects connected with them, and trace them to their sources, I believe that we should go to the nations of Guatemala and Mexico.

At the conclusion of the paper, which was illustrated by a large drawing of the Calendar Stone, remarks were made by various members of the Society.

Mr. George P. Handy was elected a regular member.

Messrs. Samuel R. Singer, George B. Twitchell and Rev. Raphael Benjamin were proposed for regular membership.

The following resolution, recommended by the Executive Board, was submitted to the consideration of the Society:

"*Resolved*, That the Amateur Photographic Club be granted the use of the meeting room of the Society one evening each month, this permission to be subject to the approval of the Society at large."

Dr. Dun, on behalf of the the club, stated that it desired some place in the city where it could hold monthly meetings; that it was able and willing to pay for gas or fuel consumed, and that the meeting would be open to all members of the Society.

Dr. Langdon stated that if the grant was made, it would open the way for any or all clubs or associations to make similar applications, and entitle them to expect similar privileges. He thought, too, that the privilege should not be granted for an indefinite period of time.

Dr. Dun then amended the resolution to read that the room be granted to the club "one evening each month for a period of six months."

After some further discussion, the resolution, as amended, was carried.

The Custodian called attention to a number of exchanges which were on the table. Among them was a set of the publications of the Geological Survey of Canada, a valuable addition to the library; also a set of plants and sections of woods from the West Indies, and forty-one species of fossils from the Cincinnati and Trenton groups.

Donations were announced as follows: From Bureau of Education, Annual Report of the Commissioner for 1882–83; from Davis L. James, Ohio Statistics for 1859, 1873 and 1878; from Chief Signal Officer, Monthly Weather Review for September; from U. S. Fish Commission, Nos. 30, 31, Title, Index and Plate of Vol. IV., Bulletin of U.S. Fish Commission; from U. P. James, four species (*Stromatopora tubularis*, *S. ludlowensis*, *Monticulipora falesi* and *M. ohioensis*) of fossils lately described in the JOURNAL; from George W. Harper, two species of shells, and other specimens, from Peak's Island, Maine.

Adjourned.

*THE DEERCREEK MOUND.**

Report of Its Excavation and Location.

By Walter A. Dun, M. D., M. R. C. S.

On the 26th day of June, 1876, in company with Mr. Scott Cunningham, now a hardware merchant in Chillicothe, Ohio, I commenced the excavations, the results of which lie before you to-night.

The mound, which was the principal object of our work, was situated on a farm owned by Mrs. Heath, and located on the banks of Deercreek, nine miles from Chilicothe, and a few miles north of the road leading from Chillicothe to Clarksburg. The mound is located upon a bluff, which is composed of shale covered with a layer of clay and some drift, about two hundred and fifty feet high, and which forms a projecting promontory into the valley of the creek. The distance from the creek is about a third of a mile, down the precipitous shaly bluff and across a narrow strip of fertile black loam that lies on the level with the creek banks. Deercreek is at this point a stream of considerable importance. It rises in Clark County, Ohio, and after traversing the counties of Madison, Fayette, Pickaway and Ross for about a hundred miles, empties into the Scioto River about six miles below the situation of this mound. This portion of the stream is consequently extremely liable to rapid fluctuations from the rains falling in the various parts of its basin. The overflows at this point are frequent and damaging, and carry out into the narrow black loam of its valley a quantity of muscle shells, which appear in nearly every spadeful of earth; and, in various stages of disintegration, are becoming rapidly incorporated with the soil. The shale of the bluff belongs to the great shales of the Devonian age, and has undergone atmospheric disintegration at the exposures. The crown of this bluff is covered with a thick yellow clay containing small rounded peebles, so characteristic of the drift formation. From the north bank of the creek a broad first bottom extends for a couple of miles, and then merges into a country more rolling in character.

Covering the bluff and mound was the native forest undisturbed. Many trees, including some on the mound, were two or three feet in diameter, and no doubt dated back some centuries. The forest growth was so dense, on and around the mound, as to seriously obstruct the prospect from its summit. But here and there in the breaks of the foliage, the extent of

* This paper, by Dr. Walter A. Dun, was read at the meeting of the Society for January, 1884. It was referred to the Publishing Committee, but has been delayed until the present time.—Note by Editor.

the view could be realized if it could not be carefully noted. The smoke of trains, to the north, on the Muskingham Valley Railroad, distant about fifteen miles, could be easily seen, and thus the progress of the trains back and forth, from east to west, discerned for over an hour. The level country still further away and beyond the railroad, thickly crowded with trees extending for miles, beautifully bounded the horizon. The view from the summit of this mound, situated as it is in on a peninsular bluff, extends for miles to the west, north, northeast, east, and southeast. Mount Logan, near Chillicothe, about ten miles away, is visible, as also the range of hills extending northward to the east of the Scioto River. Mention has been made of this wide range of view, because of the fact, that a theory exists, that the mounds were used as places to build signal fires upon, in order to quickly carry alarm over a wide extent of country—a species of telegraphing which has been used by many nations, and even within a few centuries in Scotland. This has been very strikingly portrayed by Sir Walter Scott in his novel, "The Antiquary." It may, however, not be out of place to remark, that on the mound, at present considered, no evidences were discovered which would warrant the conclusion that it was over the seat of a single fire. Clay is noted for its baking properties, and although the summit had been disturbed and become the place of burial by some later inhabitants, still, evidences of a large fire *in situ* were entirely wanting:

The natural curve of the original stratum of soil, on which the mound rested, was slightly convex; sloping more rapidly and decidedly toward the side by the bluff, making it rather difficult to decide in that direction just where the mound ended and the original soil began. The measurements, as near as we could determine, were: circumference, 361 feet and a few inches; diameter, 115 feet; height, 33 feet. Calculations from these figures show that the area covered by the base of the mound was, 10,384½ square feet, and the entire amount of earth used in its construction was 114,229½ cubic feet. The mound was conical in structure, with a circular base, and the slope of the sides was about thirty degrees. Externally, the work seemed to be in an extraordinary state of preservation. The sides were steep, and what was to be especially noted, were not washed here and there into furrows and ridges by the action of rains and water. The roots of the immense trees and old decayed stumps had displaced the earth to a very limited extent, immediately about the point where they entered and buried themselves in the mound. An excavator had dug a hole in the north side, about half way up the mound and at a slight angle, to the depth of about eight feet. This was quite recent, and the man who

did the work told me he found only one flint arrow-point in that hole. The layers of the earth in this hole were dark and mouldy, but nothing else was apparent that related to the mound. A small and old depression was afterward found on one side of the mound about a third of the way down the side, which was undoubtedly at one time the external opening of a burrow of our common ground hog. (*Arctomys monax.*)

The large size of the mound and its height inclined us to the view that it belonged to the class known as sepulchral mounds. Following the usual plan,* we began to sink a shaft from the apex to the base. This shaft was circular in shape and six feet in diameter. The apex of the cone was so distinctively marked that a perceptible curve was embraced in the outline for the top of the shaft; all of which only shows the very fine state of preservation of this monument.

Throughout the valley of Deercreek, from the lower portion of Madison County, to its end in the Scioto Valley, a distance of over forty miles, are found many remains of the Mound Builders. These are numerous and close together at the lower end and richest part of that basin, and are scattered out and become separated by wider and wider distances as one ascends the creek.

From the top of this mound many earth-works and mounds, situated in the valley or on the neighboring hills, are easily seen, notwithstanding the fact that the tall trees and dense foliage of the native forest, covering this mound, and the surrounding fields, obstructs by far the largest portion of the view. It may not be out of place to remark that the growth of timber and bushes at this place was such as to completely obscure the mound at the distance of a few hundred feet. In more immediate relation to this large mound are three or four smaller ones, varying in height from two to four feet. One of these smaller elevations is situated at the center of an embankment, of which only a semi-circle is built, the walls of which are three feet high, and the ends are separated by the diameter of the circle, which is fifteen feet. All these lesser earth-works are situated within two hundred feet of the base of the large mound, and are located further back from the edge of the bluff than the mound. They are, like it, covered and obscured from view by the dense undergrowth, so that you only see them when a few feet away. The small semi-circular embankment already described, with a small mound as its center, is situated around the portion of the small mound farthest from the large mound. No other works were discovered closer than half a mile, except those here described.

In the course of sinking the shaft the following points were noted :

*That of Squier and Davis.

The work of excavation for the first six feet was quite easy. The earth was soft, easily crumbled, and was readily thrown out with a spade alone. Two feet from the surface we reached some human remains in a very poor state of preservation. Some bones of the feet, the upper ends of the tibia and fibula, and lower end of the femur, were all recognized, but crumbled away very soon. The other parts of the skeleton were not recognized, and either had never been buried here, or had so far disintegrated as to have escaped observation.

At the depth of six feet other human remains were found so far disintegrated as to be identified only by a portion of the temporal bone of the skull. Between these two remains, at the depth of about five feet, an angular piece of porphyry, polished on one side, and evidently a piece from a broken celt or ax, was found.

The loose character of the earth already alluded to began to change on one side of the shaft at the depth of five feet, while on other side it continued to the depth of six feet, where the human remains were found. The earth had been a yellowish clay, similar to that of the fields about the mound, and contained here and there remnants of charred wood and ashes, in very small fragments. This presence of small bits of charcoal and minute quantities of ashes was noted throughout the shaft, at all depths. No reddened clay, baked or partly baked, was to be found at all, either near or apart from these evidences of fire. The loose character of the soil began to change at the depth of five feet, and at the depth of six extended throughout the area of the shaft. The clayey nature was unaltered, but the layers were very hard and compact, and the stratification was more distinctly visible. The spade was now completely useless. A pick was necessary, and was found necessary throughout the future digging of the shaft. The clay soil seemed quite dry, and very hard; so that progress from that point was slow, tedious, and laborious. A hollow sound was also quite perceptible in the process of picking, and was remarked and speculated upon for some time. At the depth of ten feet another layer of soil was reached underlying what has been already described. It was darker in color, and seemed to be a mixture of the soils of the bluff and valley. In this layer, at the depth of twelve and one-half feet, a groundhog hole was reached, and contained some of the bones of that animal, with others which were not identified. This was rather an astonishing depth for that animal to borrow, but no doubt is accounted for by the dry condition of the earth, and the ease with which the earth coming from the hole was disposed of, down the side of the mound.

At the depth of 15 feet, this layer of mixed earths ended, and one about

three feet thick, composed of yellower soil, was dug through. The clay soil then entirely disappeared, and a black, soft, easily-spaded soil, containing numerous specimens of the fresh water muscle, in a disintegrating state, followed. This layer was about six feet thick, and was underlaid by another of clay, similar to that on the bluff. This last layer was about one foot thick, and was underlaid by a cone-shaped cavity, containing the remains of a sepulchre, etc. The layer of clay immediately above this cone was extremely hard. It seemed to have the appearance of being wetted and then pounded down. It was picked through with the greatest difficulty. Above it, at the beginning of the layer of black soil, a piece of a meta-tarsal bone of a deer, very highly polished, was removed. By a short calculation it can readily be seen that the distance from the summit to the top of the conical cavity, in the centre of the base of the mound, is 25 feet. Before going further, I want to remark that there was no indication present of this mound having been erected at different periods. Had these layers been added one after another, with considerable intervals of time between, weeds, grasses, and other vegetation would have grown upon the first, and their roots penetrating some inches into the layer beneath, would have left their molds or themselves behind as evidence of their growth, and would have warranted the assertion that subsequent layers were added, with an interval of time between. No such evidences existed; therefore it is but reasonable and rational to believe that all the various stata, or layers, were built with only slight intervals of time between their construction. This point is especially mentioned here, because an article published in the *Popular Science Monthly*, about two years ago, advanced the theory that mounds are the accumulated dirt of ages, to which every passer-by reverently added his quota, in a similar way to that of the ancient Celts, who thus added to their piles of stones, called cairns, erected over the graves of some esteemed men, and a custom which also existed in the State of New York among some branches of the Iroquois. Notwithstanding the plausibility of the theory, it is worthless, because it is directly contradicted by the facts, and is, therefore, of no consequence.

It is also proper at this point to consider, not only the fact that a very considerable amount of labor was required to erect this mound, but also to point out the fact that a very large amount of the earth used in its construction, viz.: the black loam, containing muscle shells, six feet thick, and probably, also, half of the mixed layer above it, was of soil which could only have been procured at some distance, the most accessible point being the narrow creek bottom at the foot of the bluff. How was that soil carried up the bluff, 250 feet high? Why should they resort to the

valley for the black loam? The entire absence of washes on the outside of this mound, notwithstanding the action of the elements for several centuries at least, certifies the care taken in its construction, and suggests that it may have been covered with sod as a last layer.

The cone-shaped cavity at the base, which was perforated at its apex by the shaft, was about ten feet high, and contained the remains of a wooden vault, which had caved in from the top, falling on its contents and precipitating the earth for some feet above. In consequence it was largely filled with large lumps of broken clay. Hanging from the entire top of this conical cavity, wherever the space between its top and the loose dirt beneath permitted, was a peculiar form of plant life. Its roots were attached above, and it was pendant, small in size, long and hairlike, in some places being a foot and a half long. The color, upon first examination, seemed a brownish red, but upon closer observation, that was seen to come from the fact that the plant was dead. A few strands of this, in a large bunch, were found to present a peculiar, dull, bluish-white appearance, full of water, and rounded into a hairlike stem, with a peculiar, irregular, bulbous enlargement at the lower end This plant seemed entirely destitute of chlorophyll, and belongs to the group of fungi. It is a rather remarkable fact that plant life should exist 25 feet from the surface of the ground, with a very limited supply of moisture, and with the absolute exclusion of light. It may be that in this plant we have the forerunner of that life which will exist when this whole earth loses its heat, or fails to receive its usual supply from the sun. This plant soon withered in sunlight, so that no careful examination has ever been made of it. The dried tufts are very brittle and difficult to preserve. A few fragments I am able to lay before you to-night, and to it call the special attention of the botanists. In the loose dirt on top of the vault, a flat piece of sandstone, octagonal in form, was found. Unfortunately, however, it was struck by a pick, so that one edge was broken off. This stone was very soft, and crumbled so much upon handling that its first beauty is somewhat marred. Below, at the centre of the base of this conical cavity, was the vault, into which the earth was precipitated when the wooden top decayed and gave way. When entirely cleared of dirt and debris, this vault measured: From east to west, eight feet; from north to south, five and one-half feet, and was four feet high. This vault had posts set at each of the four corners, and was oblong in shape. The measurements given are those taken from the outside to outside of the molds made by the original logs of which it was composed. The molds made by these logs were very perfect, and gave the size and character of the timber of which they were originally composed. All of these were

undressed oak logs, and one was one foot and three-quarters in diameter. Four short pieces of logs were set upright at each corner, and served to lock and strengthen the whole. The top had originally been made of split staves about six feet long, four inches wide, and two and a half inches thick. All the wood had almost completely decayed. A few chunks were taken out with that peculiar red color so often seen in logs in a forest, which are so far decomposed that they are falling to pieces. The vault contained the skeleton of a man about six and a half feet high, lying with his feet to the east and head toward the west. On the south side of the body, nine stone arrow-points were found. About the wrists a few dozen sea shells, and around the neck, and extending over the chest and below, was a string of beads made of parts of the conch shell. Nothing further was found. The floor of the vault was covered to the depth of two and a half inches, throughout its entire area, with very black soil, the evident product of the decay of the organic matter of the body, together with that, resulting from what was placed in the vault along with the skeleton, not including the wood. Careful search was made for hair, cloth and other fragile articles of wear, but none were found. The skeleton itself was badly decayed, and only a few fragments of it were saved after the greatest care, patience and difficulty.

The Articles found in the Vault.

A brief consideration of various things found in this vault, or ancient sepulchre, seems appropriate now.

The arrow-points present many points of difference; they vary in length, in the form of the cutting edges (some being straight, others curved), in the beveling and in the degree of skill which is manifested in their manufacture. This last point is called to your special notice, for it has been a reasonable presumption that a difference of skill was a proof that man improved in art as he progressed in civilization and experience; and, therefore, the one who made and used the ruder weapon was more ignorant than the one who made and used better weapons. It is probable that very great differences of skill could be relied upon as presumptive evidence of different people, with different skill, living at different ages, and so on. It will also be equally apparent to those of you who examine these specimens, that came from the same grave, that it is only when these differences in skill are *very marked*, that any such conclusion could be drawn.

It is also a very interesting fact that all the nine stone points found together in the vault, had the peculiar square barbs, and that the piece which extends backward from between the barbs on both sides, is made

and beveled to an edge, which, in some of them, is quite sharp. These points of similarity suggest that it may have been a tribal distinction. Dr. Hill, who, for nearly forty years unceasingly collected in this vicinity, told me that he had found that certain areas (approximately made) furnished almost invariably arrow-points of a peculiar form of barbing. This observation of Dr. Hill refers to the surface relics; yet, in conjunction with the fact just noted, is very interesting in this connection. The material of which these points are composed is flint. The largest is of a very beautiful milky, bluish-white color. These are usually called arrow-points. From their size and weight it has lately been asserted that they are too large and heavy for arrows, and that they must have been spear-heads. This view for the larger ones seems reasonable, and they probably once furnished the ends to spears.

BEADS.—The sea-shell beads, which were perforated at their ends and formerly strung on strings, are (*Marginella florida*)—shells found along the shores of the Gulf of Mexico. They are very small—about a half inch long, and had, when first taken out, a polished surface and peculiar ivory yellow color. They must have formed tasteful ornaments as bracelets.

WAMPUM.—The long string of beads pendant from about the neck, was of the kind known as wampum. They were smallest near the back of the neck, and progressively increased in size until they reached the centre in front, where they met in quite a large one. They are composed of carbonate of lime, and are made from the conch-shell, though they are now much altered by age, so that the structure is detected with difficulty, and only after patient and careful investigation. There may be some of the smaller ones, which were made from the vertebræ of reptiles, but all the larger are from shells. A few of these beads of wampum show, in the drilled holes of their centre, the substance upon which they were strung, and the holes themselves do not bear testimony to any high degree of skill in drilling. They have been apparently strung upon a twisted string of some woody fibre, a small portion of which has been infiltrated by the lime of the disintegrating wampum, and thus preserved. Two beads are cemented together by lime, and when they were first taken out, numbers were found cemented together in rows of six or eight.

The octagonal flat piece of sandstone, already spoken of as found in the loose dirt above the vault, presents nothing of consequence except its form and crumbling condition. The latter is due to the action of fire, for the outside layers of it seem redder than those revealed underneath; yet no other evidences of fire existed in the locality where it was found except what has been already described, and we therefore conclude that the fire

that produced this change was at some other locality than in the mound. The molds of the logs, etc., of the vault in the adjacent earth, showed close packing from pressure or pounding.

SKELETON.—The bones were all in a very bad state of preservation; the fragments which were secured were held together only with the greatest difficulty, and by boiling in glue and varnishing afterward. This was done with the intent to supply the animal matter of the bones, which had long since disappeared.

Nothing could be noted about the injuries to the bones. One femur showed an old break near its middle, but that might have come from the caving in of the dirt from the giving away of the top of the vault. The size of the skeleton was remarkable only in length. The few bones secured do not show excessive development of processes, spines, ridges, lines, etc., for muscular attachment, and we can not say that the man was very strong. The height was considerably over six feet; enough to class him along with our tallest ordinary men of to-day. The skull was among the best preserved bones, and great care was used to keep it, as far as possible, intact. The whole, however, was quite fragile, and the occipital bone, buried an inch or two into the floor of the vault, stuck to that clay soil, and, being more brittle than the rest, broke into many fragments. Many of the thinner bones crumbled, and were lost; yet enough were saved to make a respectable showing, and to present some interesting features. The inside of the occipital bone was covered with a crystalline substance, which disappears in hydrochloric acid with effervescence, and which, I believe, is carbonate of lime. The interior of the skull revealed a small mass of black matter, irregular in shape, with a brittle, conchoidal fracture, which was the dried-up and shrunken remains of the brain.

The skull presents the rounded head when viewed from above, and a peculiar straightening and apparent elongation from the parietal eminences down. The air cavities in the temporal bones are large. The frontal sinuses are excessively large, and give rise to prominent supra-orbital ridges. The orbital cavities are rather small. The sutures of the skull are largely obliterated from age, and the thinness of the skull is quite marked.

Examination shows that the nose was large, quite prominent, and inclined to the right side. The cheek bones are high and prominent, and cavities in the bones of the face all large. The lower jaw is very deep, chin prominent, and the angle is very marked.*

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*For a detailed account of the teeth, refer to Dr. E. G. Betty's report on the same, published in the *Dental Register*, February, 1884.

The points to which your attention is mainly called in this skull, are: 1. The brachy-cephalic head. 2. The straight and long back of the head. 3. The prominent brow and large nose. 4. The deep lower jaw. 5. The marked facial angle. These are points quite nearly coinciding with the only Mound Builder skull figured in Vol. I., Smithsonian Contributions to Knowledge; also to the skull found in the Grave Creek Mound, and roughly figured by Schoolcraft in Vol. I., Proceed. Am. Ethnological Society, p. 412.

They are points of strong contrast, and great difference from the so-called Madisonville skulls, and suggest a possibility of thus proving a distinction of the Mound Builders into a race by themselves. The fact in itself calls for great care in preserving skulls, which are undoubtedly Mound Builders, by themselves, and carefully distinguishing them from skulls often found in mounds from burials by a later people. It also demands that greater care than that of mere relic plunder is called for in opening and preserving the remains of mounds. Squier and Davis assert that they only found one perfect skull. I feel pretty certain that they did not go as carefully to work to preserve them, or enough of them, for comparison, and the fact that they never reported any attempts at comparison of even different parts of the skull, corroborates my view.

There is nothing beyond the octagonal stone and the great labor of constructing the mound, that is seen in any of the artificial relics, which denotes a state of civilization or condition beyond some tribes of our historic North American Indians. We can conclude, I think, without reasonable doubt, from the age of the trees upon it, that the mound is at least three hundred and fifty years old, and, probably, much older. That would carry us back to the beginning of the sixteenth century, or further—a century before the settling of New York City. It tells us that there existed at the time of its erection an old forest growth, and that our present forest growth is either much older than it indicates in itself, in a direct line, or that it was a later forest growth than the one whose trees were buried to make the vault. An oak tree, one and three-quarters feet in diameter, indicates more than a century's growth. The sea-shell ornaments, from their position, indicates the vanity of the wearer and their probable rarity. They were, no doubt, considered valuable, just as we to-day value rare things with the same barbaric vanity—not because they possess intrinsic value, but because they are rare—and of them we make the same vain display. It is only one of the many relics of barbarism which have come down in our evolution from the barbaric to the civilized state.

*SOME CURIOUS ANIMALS.**

By Edward M. Cooper.

I have thought it might prove interesting to give a brief description of some of the curious animals that existed in past geological ages, but I must deny any claim to originality, and acknowledge that my descriptions are second hand, but derived from sources most authentic; and I assure you that the statements made are not copied from the posters of a traveling menagerie, though some of them may sound sufficiently exaggerated for even *those* reliable essays on natural history. That these wonderful beings have lived at some period of the earth's history, there is no room for doubt, as all the great museums of the world have been enriched with more or less of their remains—even our own Museum containing both casts and actual portions of some of them.

The first one to which I shall call your attention is known as the Megatherium—the word meaning great or huge wild beast—being the name given by Cuvier to a large extinct animal belonging to the Order Edentata. A nearly complete skeleton, found on the bank of the River Luxan, near Buenos Ayres, and sent, in 1789, to the Royal Museum at Madrid, long remained the principal, if not the only, source of information with regard to the species to which it belonged, and furnished the material for many descriptions, notably for that of Cuvier, who determined its affinities with the sloths. In 1832 an important collection of bones of the Megatherium were discovered near the Rio Salado, and were secured for the Museum of the College of Surgeons of England; and these, with another collection found at Luxan in 1837, and now in the British Museum, supplied the materials for the complete description of the skeleton published in 1861 by Prof. Owen, the British geologist. He conclusively proved that the Megatherium was a "ground sloth," and fed on the foliage of trees, uprooting them by its great strength, or pulling down the branches with its formidable forearms, resting on its hind legs and tail as on a tripod. Other skeletons have since been received by several of the continental museums—as Milan and Paris.

In size, the Megatherium exceeded any existing land animal, except the elephant, to which it was inferior only in consequence of the comparative shortness of its limbs, for in length and bulk of body it was its equal, if

* This paper, by Mr. Cooper, was read at the June meeting of the Society, and its publication has been deferred to the present time. It was illustrated by a number of magic-lantern views of the animals spoken of, prepared by Chas M. Woodward.—Note by Editor.

not superior. The full length of a mounted skeleton from the fore part of its head to the end of the tail is eighteen feet, of which the tail occupies five feet. Taking all the various points of its structure together, they clearly indicate affinities both with the existing sloths and with the ant-eaters; the skull and teeth more resembling those of the former, and the vertebral column and limbs the latter. It is not difficult to infer the food and habits of this enormous creature. That it was a leaf-eater there can be little doubt; but the greater size and more complex structure of its teeth might have enabled it to crush the smaller branches, as well as the leaves and succulent shoots, which form the food of the existing sloth. It is, however, very improbable that it climbed into the branches of the trees, like its diminutive congeners, but it is far more likely that it obtained its subsistence by tearing them down with the great hook-like claws of its powerful prehensile forelimbs, being easily enabled to reach them by raising itself up on the massive tripod formed by the two hind feet, firmly fixed to the ground by the one huge falcate claw, and the stout, muscular tail. The whole conformation of the hinder part of the animal is strongly suggestive of such an action. There can also be but little doubt but that all its movements were as slow and deliberate as those of its modern representative.

Dana, in referring to the Megatherium, says: "It exceeded in size the largest rhinoceros. The length of one of the skeletons is eighteen feet. Its massy limbs were more like columns for support than like organs of motion; the femur was three times as thick as an elephant's; the clumsy tibia and fibila were soldered together; the huge tail was like another hind leg, making a tripod to support the heavy carcass when the animal raised and wielded its great arms, and the hands, terminating the arms, were about a yard long, and ended in huge claws."

The greater portion of the remains of the Megatherium as yet found are from the Post-tertiary geological formations of the Argentine Republic and Paraguay, or the lands forming the basin of the Rio de la Plata. Dr. Leidy has described, from similar formations in Georgia and South Carolina, bones of a closely allied species, but smaller.

The next animal is the Mastodon—the name meaning nipple-tooth—in reference to the conical projections on the molar teeth of some of the species, and given by Cuvier to a genus of extinct elephant-like animals. In size, general form, and principal osteologieal characters, the Mastodon resembled the elephant. It is by the teeth alone that the two groups are to be distinguished, and so numerous are the modifications of these organs in each, and so insensibly do they pass by a series of gradations into one

another, that the distinction between the two is an arbitrary and artificial one, though convenient and even necessary for descriptive purposes. As in other proboscideans, the teeth of the Mastodon consist only of incisors and molars. The incisors, or tusks, are never more than a single pair in each jaw. In the upper jaw they are always present, and of large size, but apparently never so much curved as in some species of elephants, and they often have longitudinal bands of enamel, more or less spirally disposed, upon their surface, which are not met with in elephants.

Lower incisors, never found in true elephants, are present throughout life in some species of Mastodon, which have the symphysis of the lower jaw greatly elongated to support them. In the common American species —*M. Ohioticus*, Blum.—there were two tusks in the lower jaw in the young of both sexes; these were soon shed in the female, but one of them was retained in the male. In other species no inferior tusks have been found; at all events, in adult life.

Mastodon remains were first discovered at Albany, N. Y., and described by Dr. Mather in the Philosophical Transactions for 1712. The first specimens seen in Europe were found thirty years after by Lonqueil, on the edge of a marsh near the Ohio River, and hence the French called the unknown creature, "The animal of the Ohio." Bones have since been found as high as 70° north, but they mainly frequented a more temperate zone; and we have no evidence that any species was specially fitted like the Mammoth to brave the rigors of an Arctic winter. The remains occur chiefly in the United States, Europe, and India. They must have roamed in considerable numbers among the hills and valleys of the interior states of this country, for the teeth and portions of the bones of many individuals have been found. Several years ago some large skeletons of the Mastodon were dug up in a marsh near Newburgh, N. Y. The late Dr. J. C. Warren, of Boston, obtained one of them, which he set up in his private museum. It is eleven feet high, and seventeen feet long to the base of the tail. The length of the tusks is twelve feet, of which two and one-half feet are inserted in the socket. The estimated height of the animal when living was from twelve to thirteen feet, and the whole length, adding seven feet for the horizontal projection of the tusks, from twenty-four to twenty-five feet. Remains of the undigested food were found between his ribs, showing that he lived in part on spruce and fir trees. The range of the genus Mastodon in time was from the middle of the Miocene period to the end of the Pliocene in the Old World, when he became extinct; but in America several species, especially the best known, owing to the abundance of its remains, which has been variously called *M. Ohioticus*, *M. Ameri-*

canus, and *M. giganteus*, survived quite to a late Pleistocene period. Their remains are met with most abundantly over the *northern* half of the United States, though occurring also in the Carolinas, Mississippi, Arkansas and Texas. The best skeletons have been dug out of marshes, in which the animals had become mired. Three perfect skeletons have been obtained from the fresh water marshes of Orange Co., N. Y.; another from near Cohoes Falls on the Mohawk; another in Indiana; one from a morass in New Jersey, and another on the banks of the Missouri, while *portions* of its remains have been found in this and many other states.

The Glyptodon was the gigantic representative in the Pleistocene times of the armadillos of South America. It was furnished with a huge carapace, or coat of mail, formed of hexagonal plates, united by sutures, and constituting an impenetrable covering for the upper part of the body and the tail—the carapace differs from that of the modern armadillos in having no greaves or joints, for the purpose of contracting or rolling up its body. The head was defended by a tesselated bony casque. The tail possessed an independent dermal sheath, or cuirass, and must have been a very formidable weapon. The bones of the leg and foot were perfectly adapted to bear the steady pressure of this enormous weight. The teeth, numbering eight on each side of each jaw, are sculpterd laterally by two wide and deep channels, which divide the grinding surface into three portions. The generic name was derived from the fluting of the molars. The remains of one of these animals measured from snout to the end of the tail following the curve of the back eleven feet; the tesselated trunk armor being six feet, eight inches in length, and nine feet across, and probably weighing more than a thousand pounds. The Glyptodon does not appear to have emigrated from the central regions of South America, but formed part of a local fauna of the highest interest, which is only faintly represented by the living armadilllos.

The Pterodactyle is one of the most extraordinary of all the creatures yet discovered in the ruins of a primeval world. Collins, in 1784, was the first to investigate the character of this strange animal; he considered it a a fish; Blumenbach decided it was a bird; Sommering, a mammal; Spix, that it was intermediate between monkeys and bats; Macleay, a link between mammals and birds, and Agassiz thinks it a strictly marine reptile. Cuvier in 1800 determined the place and name it now holds.

The *Pterodactylus crassirostris* is distinguished by a very large head, a comparatively short neck, a small trunk, bat-like wings and a tail. It has been estimated that some of these strange monsters, now happily extinct, had an expanse of wing surpassing that of the great albatross, but this

species did not measure over three feet from tip to tip of the wing. Marsh has, however, described one species from the upper Cretaceous of Kansas, which had a spread of wing of twenty-five feet, with jaws and teeth like those of a crocodile, a body like a mammal, and wings like those of a bat. It is difficult to imagine anything more hideous or grotesque than the Pterodactyle. By the excessive elongation of the little fingers of the forefeet, support was afforded to a membrane, which extended to the tail, and made a wing for flying—the remaining fingers being short and furnished with claws; the long slender jaws were set with a number of teeth in sockets; the bones were hollow and light as in birds. They had the habits of bats and wings of a similar character, and yet are properly classed with the reptiles.

The Dinotherium was a huge pachyderm, which, though its teeth were discovered more than a century ago, has not yet found a resting place in the classification of animals. Cuvier called it a gigantic tapir; DeBlainville and Pictet considered it an aquatic herbivore, resembling the Dugong; Kaup regards it as intermediate between the Tapir and Mastodon, and truly terrestial; while Owen says it is a hoofed quadruped of probably aquatic habits. One of the singular features in connection with this animal is the enormous down-curving tusks, which were probably used in tearing up the roots of water plants needed for food—though Ansted thought they might also be used as anchors to attach the animal at night to the bank of the river or lake in which it dwelt.

The Plesiosauris was first discovered in 1823 by Coneybeare and DeLa-Beche. Cuvier thought "its structure the most singular, and its characters the most anomalous that has been found amid the ruins of a former world." To the head of a lizard (wrote Buckland) it united the teeth of a crocodile; a neck of enormous length, (consisting of from twenty to forty vertebræ) resembling the body of a serpent; a trunk and tale having the proportions of an ordinary quadruped, and the paddles of a whale.

The Hesperornis was a water bird, with powerful swimming legs and feet, peculiarly adapted to rapid motion through the water. The length from bill to toe was about six feet. The wings were small and rudimentary, and could have been of no service for flight. Its teeth indicate carnivorous habits, and its food was probably fishes.

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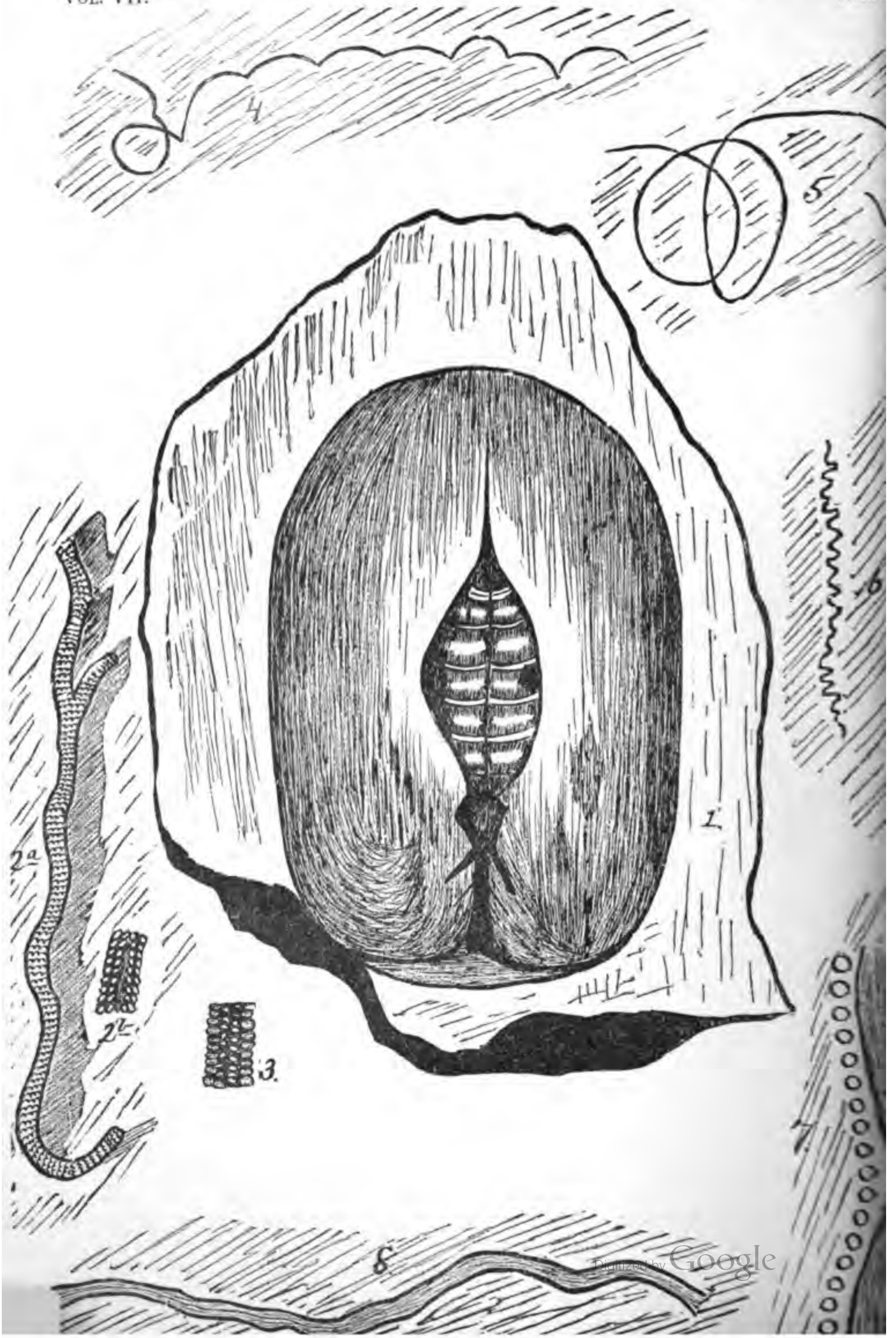
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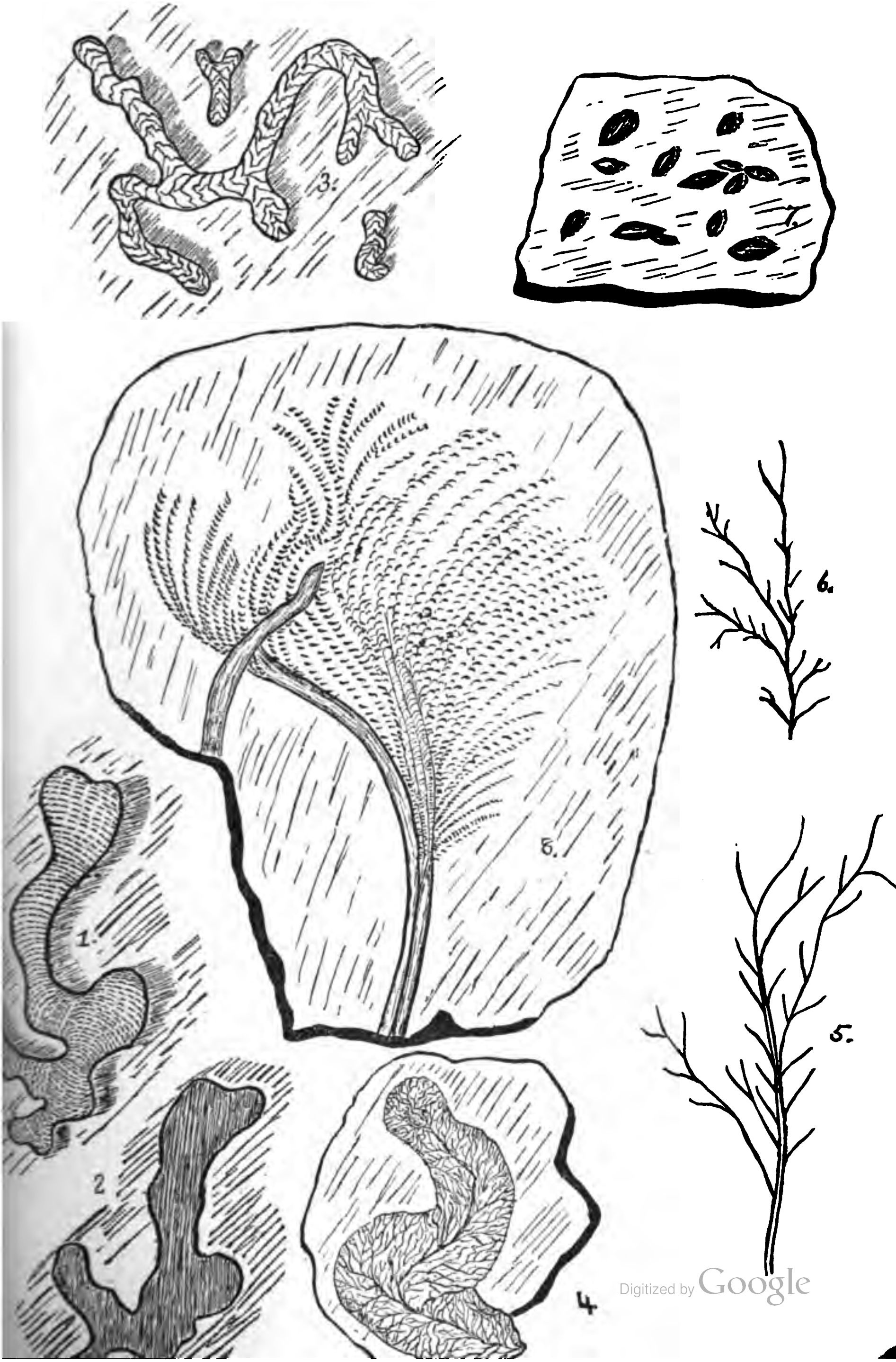
Description of Plate VIII.

Description of Plate IX.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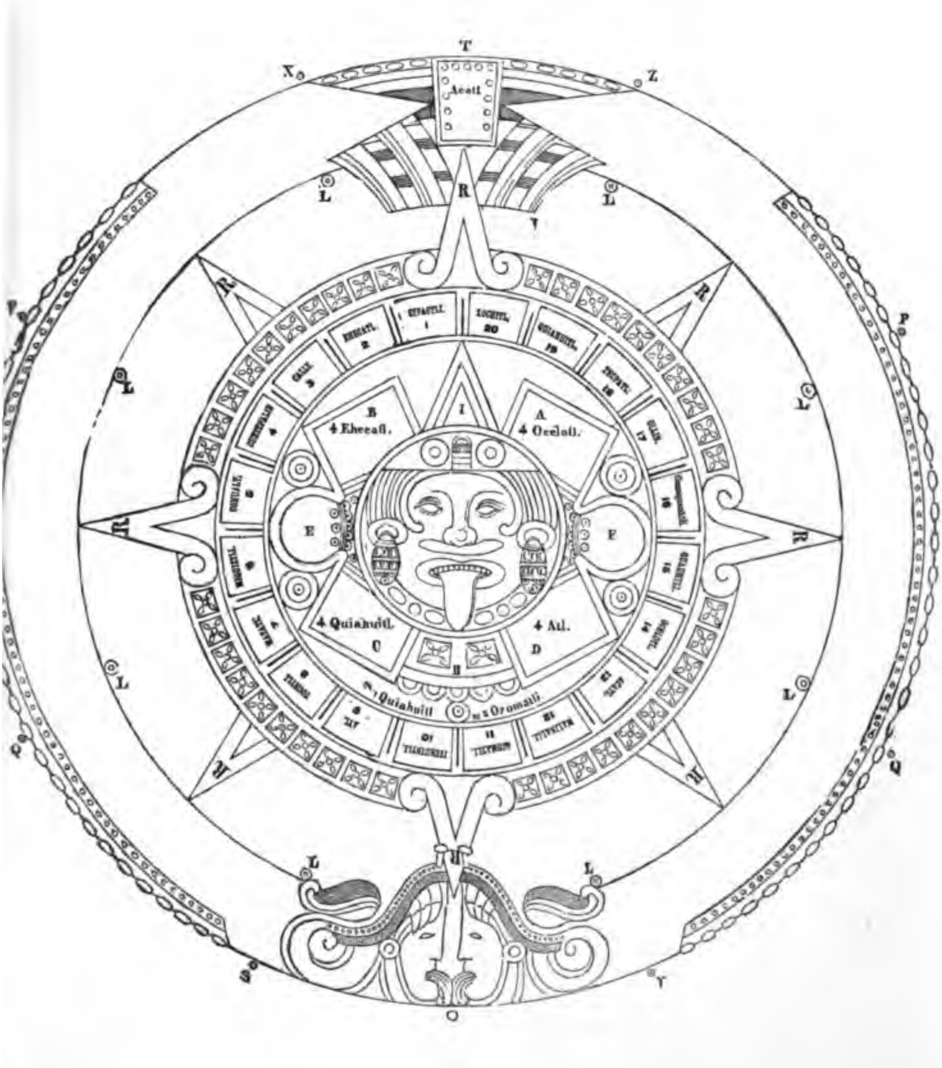
Description of Plate X.

T.—Hieroglyphic of the year 13 Acatl (twenty-sixth year of cycle).
A. – " " day 4 Ocelotl (22d of May) in first year of cycle.
B.— " " " 4 Ehecatl.
C.— " " " 4 Quiahuitl (26th of July) in first year of cycle.
D.— " " " 4 Atl.
H.— " " " 10 Ollin (22d of September) in first year of cycle.
M.— " " " 2 Ozomatli (22d of June) } in twenty-sixth year of
N.— " " " 1 Quiahuitl (22d of March) } cycle.
E, F.— " of two astrologers.
R.—The right rays of the sun.
L.—Subdivision of the sun.
P, P, Q, Q }
S, Y, X, Z } Holes in the edge vertical to the surface of the stone.
I.—Triangle, summit of which indicates the first and last day of the month.

The names of the days, CIPACTLI, EHECATL, CALLI, etc., have been substituted for their hieroglyphics.

THE CALENDAR STONE.



THE

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OF THE

CINCINNATI

SOCIETY OF NATURAL HISTORY.

VOL. VII.

1884–85.

Publishing Committee.

JAMES W. ABERT,
GEO. W. HARPER,
DAVIS L. JAMES.
A. P. MORGAN,
WALTER A. DUN,
JOSEPH F. JAMES.

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ELM STREET PRINTING COMPANY, NOS. 176 AND 178 ELM STREET.
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1885. No. 1.

SOCIETY.

MEETING OF *January* 6, 1885.

As there was not a quorum present, no business was transacted.

An informal discussion took place on a short paper, read by Prof. Joseph F. James, on "Evidences of Beaches in the Cincinnati Group," the author holding that the tracks and burrows found in the rocks, were evidences of the presence of beaches at the time the rocks of the Cincinnati Group were deposited.

The donations for the month were as follows: From Lieut. Thos. L. Casey, "Revision of the Stenini of America North of Mexico;" from G. H. Curtis, Ten Microscopic Slides of Hairs and Scales; from Kentucky Geological Survey, Four Volumes of Reports; from Chief Signal Officer, "Monthly Weather Review" for October, 1884; from Bureau ot Ethnology, "Second Annual Report, for 1880–81"; from Nelson Perry, Specimen of Wire Silver; from John G. Morgan, Gold and Silver Ores from Colorado; from Ohio State Librarian, Vol. V., Geological Survey of Ohio; from T. H. Wise, "Young Mineralogist," Vol. I., No. 6; from E. S. Clark, M. D., Thirty-nine Species of Fossils, from Louisville and Clark Co., Ind.; from Jos. F. James, Eight Species of Fossils, from Louisville; from C. R. Brown, Specimens of Human Bones, from a gravel deposit: bear's tooth, flint celt, and Mastodon bone and part of tusk.

The fourth course of Free Popular Scientific Lectures, given under the auspices of the Society, began on January 2d. The first of the series was by Prof. Wm. L. Dudley, on "Water Crystallization." The lecturer began by explaining the process of the freezing of water. This takes place when the temperature falls to 32°; and,

contrary to the general rule of substances, water expands instead of contracting when it is cooled. If a goblet of water be placed under certain conditions, it will not freeze, even if cooled several degrees before freezing point. But if agitated ever so slightly, by jarring, for example, congelation immediately ensues. Snowflakes are always six-sided, or have six rays. The expansive power of water when freezing, was shown by experiments made at Quebec. An iron bombshell was filled with water, and a peg driven into the hole. After a few hours exposure to a temperature of 25° below zero, it was found that the peg had been driven out of the hole to a distance of one hundred feet, and a core of ice six inches long was shot out of the aperture. The method of making artificial ice was explained, as was also regelation, or the freezing of two pieces of ice when brought into contact. The pasticity of ice and the movements and appearance of glaciers was spoken of. The lecture was illustrated by magic lantern views.

On January 9th, Dr. W. A. Dun gave a talk upon some magic lantern pictures. He prefaced the exhibition by remarks upon the necessity of a Natural History Museum, and showed what a chance there was for some of the rich men of the city to rise and put the Museum of this Society on a firmer basis, and thus erect for himself a durable and magnificent monument. The views shown were of the Zuni Indians, and scenes from various parts of this country and Europe.

On January 16th, Prof. J. W. Hall, Jr., lectured on "Gems and Minerals." He explained many of the popular superstitions concerning minerals. The ancients believed them to be alive, because, said they, they become ill, decay and die. The opal was formerly regarded as a lucky stone, preserving the owner and wearer from many ills. Now it is regarded as a gem of ill-omen, and even people of intelligence refuse to wear opals because of the fear of bringing misfortune upon themselves. The history of the diamond was fully entered on. It is, like coal, pure carbon, only having undergone some peculiar treatment which makes it what it is. The etymology of "diamond," the manner of finding the stones, and a history of the most celebrated gems were given. All the more noted diamonds have had eventful histories, in which

murder and intrigue have played a very prominent part. Some were found by slaves and sold for small sums, changing hands many times and increasing in value each time. The Grand Mogul, belonging to Russia, is valued at $1,500,000, and the Koh-i-noor of England, is worth $800,000.

On January 23d, Prof. Joseph F. James, lectured on "The Ancient Vegetation of the Earth." He spoke of the difficulties of preserving Algæ from decay, and said, that though no doubt the seas of early geological ages swarmed with Algæ, yet it is doubtful if many have been preserved. The peculiarities of the flora of the Carboniferous Period, and the manner of formation of coal were described. The flora of later geological periods, Cretaceous and Tertiary, was spoken of, this being the forerunner of the present flora of the earth. A review showed that there was a general advance in structure of plants from the earliest to the latest geological periods.

On January 30th, Col. James W. Abert lectured on "Nature in Art." He defined Nature as concerned with material things, animate and inanimate, and Art as man's expression of Nature. Artists conventionalize from Nature, changing her forms to suit their purposes, especially in decoration. In painting landscapes, they select the agreeable and pleasing, but reject the inharmonious. The number of wave lengths in different colors varies. There are 400 trillions in red, and 720 trillions in violet. The sound waves on a seven octave piano vary from 40 to 4,000. The mixing of colors is a great art, as is also the massing of colors in pictures to give the best effects.

MEETING OF *February* 3, 1885.

Vice-President Skinner in the chair. Sixteen persons present. The following papers were presented and referred to the Publishing Committee:

THE ANCIENT AZTEC OR MEXICAN METHOD OF COMPUTING TIME,

As shown by the Description, by ANTONIO LEON Y GAMA, of the Celebrated *Calendar Stone*, found in the Grand Plaza of the City of Mexico, in 1790—
Translated from the Spanish, by

COL. JAMES W. ABERT.

PRELIMINARY DISCOURSE.

I have always been possessed with the thought that in the Grand Plaza of this city and at the gate of Santiago Tlatelolco there would be found many precious monuments of Mexican antiquity, because the first place included the site of the grand Temple of Mexico, which was composed of seventy-eight edifices, including small temples, chapels and the dwellings of priests and ministers. There were kept, not only the numerous false gods, which they worshiped in blind idolatry (which were of hard stone, and of excessive magnitude and weight, and, for that reason, difficult to carry off), but also many instruments which they used in their arts and duties; also, historical and chronological records, which were preserved, engraved in great stones by these same priests, whose charge was the care of the memorials of the deeds of their ancestors and of everything else connected with their political and religious government; in the second place, Tlatelolco was the last stronghold, where the Indians retreated and maintained themselves until the day of the capture of their city. It seemed most probable that there they would have brought their Penates, or less weighty idols, as well as all materials they had fabricated, which they regarded as most precious, and which they kept in their own dwellings, as well as all the jewelry and treasures which they possessed, and other valuables which served to adorn their idols; and all the riches that the Spaniards lost the night they were driven out of Mexico, which riches they could not afterward recover, notwithstanding the great diligence and solicitude they exerted, even in searching the whole lake, into which the Indians said they had thrown them. It was then most probable that all of their things, or at least the greater part of them, might be buried in the earth

at Tlatelolco. If one should make excavations, as it was proposed to do in Italy, in order to find statues and fragments, which would bring back the memoirs of ancient Rome, and which was actually done in Spain at the villa of Rielves, three leagues distant from Toledo, where they discovered various ancient pavements, how many monuments might not we discover of the ancient Indians? How many books and pictures which the priests had concealed, and especially the *Teoamoxli*, in which, in their native characters, they had written their origin; the progressive moves of their nation from their exit from Aztlan until they came to populate the lands of Anahuac; the rites and ceremonies of their religion; the fundamental principles of their chronology and astronomy, etc? And what treasures might not thus be revealed?

Thus it actually happened, for in a few days we obtained revelations, which told us what the Indians were in the time of their nationality, by means of the discovery of two precious monuments, which demonstrated their culture and instruction in the sciences and arts. From these it is evident how much a particular find reveals, and how it can be an original and instructive document which displays a great deal of history and chronology, and also the exact manner in which the Mexicans measured time, for the celebration of their feasts and for their political history; for most of their histories had perished in the flames, or were lost by the inability to interpret what their picture-writing signified. What a deplorable loss those men of taste have suffered, who devote themselves to the study of the antiquarian literature of these nations!

On the occasion when the Government ordered that the Grand Plaza should be paved and leveled, and they made excavations in which to conduct the water through subterranean channels; and while busy excavating for this object, about the end of the month of August, in the year 1790, they encountered, but a short distance below the surface of the earth, a statue curiously wrought out of stone, of extraordinary magnitude, which represented one of the idols that the Indians adored in the time of their nationality. But a few months passed when they found the other stone, much larger than the antecedent one, only a short distance from it, and almost touching the surface of the ground, so placed that upon the upper

side, as it was found, there was no carving; but the under side, which was hidden in the ground, displayed numerous carvings. Both stones were exhumed. The first was taken to the Royal University; the second remained for some time where it was found, but was placed in a proper vertical position, so that one could note readily all that was engraved upon it. As soon as I saw it I was filled with delight at having found in it a faithful testimonial, which proved what I had written with the cost of so much labor and study in regard to the system of Mexican calendars, and against the false hypotheses with which some have confused and disfigured their works while pretending to explain the history of the Indians, which things I have demonstrated in my Indian chronology, and have pointed out the most notable errors of former writers in this work.

As I had been engaged for some time in making examinations of the manuscripts of the Indians in the Mexican idiom, as well as of the narratives of our own Spanish histories, together with the picture-writings in my possession, cited in that work, it was easy for me to comprehend what was the signification of the carvings and figures engraved upon this second stone, bringing to my mind by its means all the images which we find so confused, dispersed and mutilated, in the writings of the Indians themselves, and in no manner explained by Spanish authors. And although I succeeded at the cost of great labor in comprehending others which had not previously been brought to my notice, still there remain some of their figures, whose hieroglyphics involve too many allegorical significations to be entirely interpreted.

On account of its being exposed to the public and without any care, it was difficult to prevent puerile and rustic people from mutilating and maltreating it, and injuring the carvings with stones and other instruments much more than it had suffered up to the time of raising it, so that before they should injure it more we could dispose of it in a different manner than at first intended. I caused to be made, under my supervision, an exact copy of it, to be kept in my possession as an original monument of antiquity, and I drew up a few annotations in regard to what the carvings meant. But having communicated them to several persons, curious in such

matters, they insisted that I ought to publish my explanation, and knowing that if I omitted to do so, or to publish the copy (if by any casualty it might be destroyed, or if it should suffer the destiny once intended for it, the work would perish, and there would remain no copy, or notice, of what this great monument contained), the ancient history of Mexico would suffer the same misfortunes which it had suffered for so many years by the loss of former records, which had been cast into the fire because no one had any appreciation for them, or had been purposely concealed in the earth.

I determined to publish the description of both stones, in order to contribute information to antiquarian literature, which is so much encouraged in other countries, and that our Catholic monarch, Senor Don Carlos III. (whom God preserve!), being King of Naples, promoted by means of the celebrated museum which, with the cost of enormous sums of money, he caused to be founded at Portici, from the excavations he caused to be made in discovering the ancient cities of Herculaneum and Pompeii, buried for so many ages under the ashes, stones and lavas of the eruptions of Vesuvius.

I was impelled also to manifest to the literary world the great knowledge that the Indians of America possessed in arts and sciences in the time of their nationality, in order that it should know how falsely they were caluminated by unreasonable or senseless people, enemies of the Spaniards, with the purpose of sullying the glorious exploits achieved in the conquest of these regions. By the narrative of this paper and by the figures it presents to view, will be manifested the dexterity of the artificers who made these works, since they had knowledge neither of iron nor steel, but they engraved with such perfection in hard stones, statues which represented their intended semblances, and made other works in architecture, using in place of tempered chisels and sharpened picks stones that were more solid and harder.

In the second stone were manifested various departments of the science of mathematics, which they knew to perfection. Its volume and weight demonstrated their knowledge of mechanics and machines, without the fundamental principles of which they could

not cut it, or transport it from the place of quarrying it to where it was located. By the perfection with which they formed the circles, by the concentric arrangement maintained between them, by the exact division of the parts (of the circumference), by the direction of the right lines to the center, and by other particulars which are not used by those who are ignorant of geometry, is manifested the clear knowledge of this science possessed by the Mexicans.

In regard to astronomy and chronology, similar interpretations derived from this stone, which we are going to explain, will demonstrate how familiar they were with observations on the sun and the stars for the measurement of time and its distribution into periods, which had a certain analogy with the movements of the moon, of which they found a "solar-lunar" year, which served to regulate their festivals on certain determined days, so that they could not vary from the times prescribed for their rites more than thirteen days in the prolonged interval of fifty-two years, at the end of which cycle they reformed their civil year.

The various stories that our old Spanish historians narrated about the magnitude and the material of which the Indians fabricated their false gods, and the prejudices which our first religious men conceived when preaching the Holy Evangelist, in regard to what they saw engraved on stones, or depicted on cloth or paper, as an object of idolatry, occasioned the confusion in which all found themselves, without knowing how to discriminate which were the symbols which belonged purely to the worship of their gods, and which appertained to their histories.

The latter were regularly engraved upon large stones, and upon the portals of the palaces of their chiefs they depicted the exploits of their ancestors. There was no city or town which did not contain engraved upon the stones of its walls, or on the rocks of its mountains, the year of its foundation, the origin of its name, who were the founders, and the progress made in it—all represented in symbols and characters that none understood but the Indians themselves, without whose aid it was not easy for the Spaniards to comprehend them. As the Spaniards were ignorant of what these figures signified, they demolished many objects belonging to his-

tory, believing them objects of superstitious rites. The Indians, some fearful that they should be accused of returning to idolatry, others malicious, concealed the truth of their signification, and told fables and exaggerations, not only to the Spaniards, but also to those of their own race who endeavored to inform themselves, as is narrated by Don Fernando de Alva Ixtlilxochitl at the end of the "Complete relation of all things which have happened in New Spain," which refers to their political and historical events, but they all maintain silence in that which regards their ancient religion. There is no one who makes mention in his writings of all their gods, of the forms in which they figured, of the various attributes which they possessed, of their transformations, and the offices with which they distinguished them, and of the mode of worship rendered them, and although one or another gave a slight idea of them, and some curates and monks knew much, still, that which they wrote was so little and so obscure, that no one can form a complete idea of their mythology; notwithstanding, by combining the manuscripts of anonymous authors, and what was subsequently promulgated by curates and monks, one can obtain a good deal, but with the cost of great labors. Those of the monuments, whose description we propose to give, have the good fortune of being verified in the express relations and authority of persons of the most distinguished character, as well as regards their literature, as in the order of events, to which we are obliged to give the greater credit on account of their high antiquity, (but it is no little matter, in things so obscure as the history of the Indians, to find authorities printed which confirm what one has obtained with so much labor). The manuscript narratives in the Mexican language, of which I have made use, are most reliable and truthful. I do not find in them the contradiction I find in others, neither in the substance nor in the manner of relating events, for which reason they always have their highest value with the Spanish savans who possess them. But in some the details are so meager that you learn but little or nothing in regard to the Indians, relating to their mythology, chronology and astronomy.

From these and other writings, and from ancient picturegraphs, I have deduced the signification of the two stones; but as it requires

for their proper intelligence, that one should know the manner in which the Mexicans divided their time, and their calendars and their "Tonalamatl," and especially in order to be able to comprehend perfectly the interpretation of the second stone, we will divide our explanation into four sections or parts. The first will contain the general method of observing and distributing time into fixed periods of cycles, years, months and days, and their aliquot parts, in all that regards their weeks, or rather trecenas, of which they composed their Tonalamatl, in which you will find an account of the first of the two stones we have found (*i. e.* the Statue). The second part will be the explanation of the idol stone (*i. e.* the Statue). In the third will be contained in brief, the computation by which they governed themselves, depending on the movement of the sun and moon, for the celebration of their festivals, for their commercial affairs, and for other uses, both civil and political, and we will establish the veritable calendars, refuting as false, erroneous, and absurd all other systems which certain authors have invented, as being entirely opposed to what the relation of the Indians themselves have established, and to the naturalness and invariable method which they observed in all matters relating to their government. We will harmonize the two kinds of calendars with themselves and with ours. We will establish the commencement of their year, with other details relating to their chronology—and finally, the fourth part will be an exact account of the carvings and symbols contained on the second stone, and of the chief purposes for which the Mexicans made use of it. But, since after the conclusion of this work, there have appeared other notices and circumstances which have more interested the curiosity of the public; in order not to deprive the people of them—it seemed to us most proper to insert them in the following

ADDENDA.

When it was announced in the *Gazeta De Mexico* of the 16th of August, 1791, that this book was concluded, inviting persons who were interested in such matters to subscribe, I was then ignorant of the important proceedings taken by His Excellency Senor Virey, Count of Rivilla Gigedo, and by the Senor Superintendent, Don

Bernardo Bonavia y Zapata, conducive to the perpetual preservation of these images, and preservation of memorials in regard to them, as precious monuments, which display the knowledge possessed by the Indian nation in the times anterior to their conquest, about which matters they took no care in subsequent times, for it was determined then to hide from the Indians all that might tend to remind them of their passed idolatries, together with what remained of the ancient history of the nation, which was wholly, or at least in part, deprived of original documents that showed this people to be one of the most civilized and statesman-like nations in the new world, and defended them against the calumnies with which foreign nations have always stigmatized them.

The same day the notice was published, the Mayor sent for me, influenced by his great benignity, and communicated to me not only the measures he had taken, impelled by his zeal, solicitude and energy, which he displayed in matters that were committed to his care; but also informed me of the legal steps he had taken upon the event of the finding of those stones; in order that the public should know all about them, as to the days, hours and places where they were found. The effect upon the antiquarian literature, and the desire to illustrate the history of Mexico, is sufficiently manifested by the official letter with which he imparted to His Excellency Senor Virey, the notice of this find; insisting, that at once measures should be taken in order that the preservation and security of the first statue should be maintained—which measure His Excellency approved, in the same terms as proposed in the official expression, which is thus stated in said letter:

"Most Excellent Sir: In the excavations which are being made in the Plaza of the Palace, for the construction of the water pipes—as you know, there was found a figure in stone of considerable size, which is acknowledged to be anterior to the conquest. I consider it worthy to be preserved, on account of its antiquity and on account of the scarcity of the monuments which remain of those times, and of the matters which contribute to illustrate them; being persuaded, that with this object in view, I could not place it in better hands than those of the Royal and Pontifical University. It appears to me most suitable to place it there, not doubting that it will

be received with delight, retaining for myself the right, if you think it proper, of causing it to be measured, weighed, drawn and engraved, in order that these details should be prepared to accompany the informations which the said college may indicate or discover, in regard to its origin.

"God keep Your Excellency for many years.

"Mexico, 5th Sept., 1790."

To this official document, Senor Virey, on the following day, the 6th, manifested his concurrence, as the following expressions denote:

"I consent most gladly, that you may transport to the Royal and Pontifical University, the stone-statue, found in making excavations at the Plaza of this Palace, and that it shall be placed in a position in that edifice, which is considered to be most suitable. You yourself (as you proposed) taking charge of the duties of causing it to be measured, weighed, drawn and engraved, in order to publish these matters, in company with the information which that illustrious college may possess, or may be able to point out, in regard to its origin."

Subsequently the Senor Rector made this same solicitation, and by another note of the same September 22d, His Excellency advised the Senor Superintendent, that he should impart to the said Rector the authenticated notice of the find; which was done in the following official document.

"In compliance with that which His Excellency, Senor Virey, was pleased to inform me, in the official note of the 22d of the last month, I transmit to you the testimony which affirms the finding of the figure of stone, in appearance, heathen, encountered in the excavations of the Grand Plaza, which, as soon as you can arrange it, will be transported to the Royal University, for the purpose of preserving it, and so that with the aid of the informations and documents in the library, one can form an appropriate dissertation. It being my duty when it is placed there, to have it to be weighed, measured and engraved, in order that, with the accounts, may be given to the public at the same time, the drawing, the weight and the dimensions. God keep you, etc.

"Mexico, 29th Oct., 1790."

In consideration of this note, it was actually transported to the Royal University, where it is now located in one of the angles of the portico; but the dimensions, weight, drawings and engraving which the Superintendent offered to make, were not made, on account of the numerous important duties which occupied his first attention, and perhaps he delayed to make them, because he had received notice that I began the labors of giving its description to the public.

By legal proceedings it is evident, that on the 13th day of August, 1790, a day memorable for being the same on which the King of Spain took possession of the city in the year 1521 (although two witnesses state ambiguously, that it was the 14th), being engaged in excavating the ditch for the stonework through which the water should flow, there was found, close to the little chests which are called after Saint Joseph, at the distance of 5 varas north of the acequia, and 37 to the west of the Royal Palace, the stone statue; the head of which was buried at the depth of one vara and a third, and the other extremity, or foot, at little less than one vara. On the 4th of September, at midnight, it was suspended and placed in a vertical position, by means of a tackle with double pulleys; and at the same hour on the night of the 25th, it was drawn away from that place, and rested in front of the second door of the Royal Palace, whence it was afterward transported to the Royal University.

But a short time had passed after its being moved, when, on the occasion of the repaving, on account of the sinking of the ancient level of the Plaza, on the 17th of December of the same year, 1790, was discovered, at only one yard's depth, and at a distance of 80 to the west of the same second door of of the Royal Palace, and 37 to the north of the "Portal of Flowers," the second stone; its posterior surface uppermost, as is testified by official documents of the 12th of February, 1791, transmitted to the Senor Superintendent, by one of the Grand Masters of N. C. D., Joseph Damian Ortiz, communicating the notice of the find.

This second stone, which is the largest and most instructive, he begged of His Excellency Señor Virey, for the Seniores, Doctor Joseph Uribe and Doctor Don Juan Joseph Gamboa, Commission-

ers of the Building of the Holy Cathedral Church; and although there is no evidence of having perfected this request by letter, or in any other legal manner, or by any decree of donation, the delivery was made on the verbal order of His Excellency, to the said Seniores, Commissioners, according to what has been communicated to me by the Superintendent, under the condition that it should be set up in a public place, where it should be always preserved as a valuable monument of Indian antiquity.

But not only were there found these two stones in the space which was repaved of the Grand Plaza, but other ancient monuments were discovered, which were not made known to the public like the preceding ones. Nothing was known about them until this same Superintendent communicated to me the notice, giving an order to the Lieutenant Colonel of Engineers, Don Miguel Costanzo, that he should inform me of all that it contained, which, in fact, he did, in terms which were put afterward in a letter. This new discovery confirmed all that I had predicted about the many antiquities that would be found in the Grand Plaza. Since if thus, in a short interval, and at but slight depth, one find such valuable relics of remote Mexican antiquity, we may readily believe that, in places not repaved, and in deeper excavations, others will be discovered which will throw new revelations on their history. The discovery was a sepulchre, that contained the bones of some animal that no one knew, notwithstanding the preservation of the head, the teeth, and the fangs, characteristics which generally distinguish the species of quadrupeds. With them were found various porringers, and other articles of clay, well manufactured; several large bells of metal, and other things of like nature. I was not able to see any of them, because they were in the possession of Captain Don Antonio Pineda, who actually resides in the City of Guanajuato.

I would hardly dare to say anything in regard to them, if it were not from conclusions deduced from what I was informed by the said Lieutenant Colonel of Engineers, and from the details he gave me, which are as follows:—

A Peon, named Juan de Dios Morales, in the month of February of this year, 1791, near the middle of the square recently con-

structed in front of the Royal Palace, inclosed with posts and chains, discovered a sepulchre of from one to two varas in length, and one vara in width, formed of slabs of "tezontle,"* very well dressed; the interior was filled with white sand, very fine, and here were found the whole bones of some unknown animal, together with various fragments of porringers of clay, similar to those from Quantitlan, but of much better manufacture, which contained some bells of copper, well cast, in the form of pears, and other trinkets of the same metal. The animal, as some inferred, from the large fangs which issued from both jaws, may have been a coyote (wolf or dog) of extraordinary magnitude; but it is uncertain if this conjecture is well founded.

Combined with the finding of this animal in a sepulchre so well constructed, in a place that was included in the limits of the grand temple, with the bells, trinkets, and many other things which were found interred together with it, taken with what has been related by Dr. Hernandez and Padre Torquemada in describing the temples, chapels, and other structures included in the grand temple, we conclude that this animal was one of the gods which the Mexicans adored under the name of "Chantico," which, according to the said Torquemada, signifies "the wolf's head." Having questioned the said Colonel as to its resemblance to a wolf, he answered that the formation of the fangs and their arrangement were similar to those of that animal. We know that among the multitude of absurd gods that the Mexicans worshiped there were several animals; as the tiger, with the name of *Tlatoca-ocelotl;* the eagle, with the appearance of the peacock, called *Quetzatme-xolo quaulitli;* the serpent, or *cilma cohuatl*, and others.

This wolf-god had a particular temple in the grand square of Mexico, with the name of *Tetlanman.* In it they celebrated their rites, with sacrifices of captives, during the rule of the sign of *Ce Xochitl.*

It had for associate another—a goddess—named *Cohua Xohotl,* according to Torquemada, and *Quaxolotl,* according to Hernandez, in whose honor, also, they celebrated the festival. Various priests were destined to the service of the god "Chantico." They had

*Stone.

their dwelling separate—a species of convent, with the name of *Tetlacmancal Mecac*, all of which the authors quoted assert, although Hernandez equivocally names the goddess *Chantico*. Therefore there can scarce be any doubt that the bones that were discovered were those of this animal, to which, on account of some special attribute, of which we are ignorant, they offered up adoration, and classed it among the number of their gods.

I.

Methods of dividing time used by the Mexicans and other nations of New Spain.

1. Since the Toltec nation (from whom the Mexicans are descended) in their ancient country, called *Huehuetlapallan*, counted their year and reformed their calendar, the division of time into constant and uniform periods remained established without any substantial variation, although in the manner of reckoning them there may be some differences, according as circumstances combined, relative to the migrations, the rites, the religious and political acts of the nations, which, in successive times, came to populate the lands of *Anahuac*. The Mexicans, who were the last who happened to establish themselves, did not forget the customs they had received from their ancestors, which were observed in *Aztlan*, their country, but having emigrated from it, they were forced to vary their reckoning for reasons which we have already stated, but they always maintained their dates constant, varying only their cycle.

2. They divided the natural day into four principal parts, which were, from the rising of the sun until midday, from midday until sunset, from that time until midnight, from that time until the next sunrise. Hence they called the beginning of the day *Yquiza Tonatiuh*; the middle of the day, *Nepantla Tonatiuh*; the sunset, *Onaqui Tonatiuh*, and midnight, *Tohual Nepantla*; subdividing, also, each of these intervals into two parts, which correspond approximately to 9 in the morning, 3 in the afternoon, 9 at night, and 3 before dawn, when they supposed the sun to be equidistant from the points of rising and midday, and from midday to setting, and from this to midnight, and from this to the rising of the sun

on the following day. These middle intervals had no particular name, neither did the hours of the day, and they designated only the position the sun occupied in the heavens, when wishing to point out the hour, saying. "*Iz Teotl*," "there is the day," or the sun.

The hours of the night they regulated by means of the stars. These duties belonged to the ministers of the temple, who wore, destined for this duty, certain instruments, like speaking trumpets, with which they announced to the people the hours at which the people should assemble for the sacrifices, and other ridiculous ceremonials belonging to their nocturnal festivals.

3. Each one of their months was composed of the aggregation of twenty natural days, which they divided into four "Quindies." On each division they celebrated "fairs" (or markets), which they called Tianquiztli. Of eighteen of their months they formed the common year, or the 360 useful days, to which they added five days at the end of the last month, and they named them *Nemontemi*, which is equivalent to calling them *vain* or *useless* days, for on these they neither worked nor engaged in any business, remaining constantly unoccupied and in anxious fear that some calamity would befall them; believing, in the madness of their superstitions, that, on the last of those five days, the world would be destroyed.

They reckoned this time as unfortunate to those creatures that were born on these "Quindies," and they always designated them as unfortunates by the names they gave them, since to males they gave the name of "*Nemo quichtli*," and to females, "*Neo cihuatl*," which signified unhappy man or woman.

Notwithstanding these five days were accounted as useless for every species of labor or political occupation, they held them in great esteem, adding them to form the complement of their civil year of 365 days, in the same way as the Egyptians, who, in order to adjust their year to an equal number of days, added to the end of their last month other five days which they called *Epagomenai*.

4. They represented the eighteen months of the year in the form of a circle, with the same number of divisions, or squares, in which they carved the respective symbols by which they designated each one of the said months. They called this kind of wheel *Xiuhtlapohualli*, or the sun. In the same circular form they represented

their cycle, which was a period of 52 years, which they named *Xiuhmolpilli*, and signified the binding together of the years. Sometimes they represented two consecutive circles; the one contained the eighteen months; the other, which circumscribed it, was the cycle of the 52 years. They surrounded this cycle of years with a serpent, that had four coils or inflections, one in each quadrant of the circle, commencing at the head, in the mouth of which the extremity of the last inflection entered, denoting in this manner that, where one cycle terminated, there another commenced. In this form was the engraving that was drawn by Dr. Gemelli Carreri in his book, or circle, of the world. Two of these periods composed the grand cycle, or century, of 104 years, which they called *Ce huehuetiliztli*, that is, an "era," or an "age;" but this age had no particular symbol in their picturegraphs, and they always divided it into two periods, or cycles, of 52 years. Each one of these half centuries was divided into four tri-decades of 13 years, which were signified by each inflection of the circumscribing serpent.

5. With four symbols only, that were represented thirteen times, they represented completely their cycle of years, or *Xiuhmolpilli*. Their symbols were: Tecpatl, flint; Calli, house; Tochtli, rabbit; and Acatl, cane. But they were so disposed that, although there were but four symbols distinguished by a particular representative, yet no one would confuse one year with another in the cycle of 52 years, or *Xiuhmolpilli*, for they distinguished them by numerical characters, which corresponded to each one of the symbols in the order as they reckoned them, although in the whole reckoning the same number was repeated four times.

For example: They commenced to count the Mexican cycle, or *Xiuhmolpilli*, by the symbol Tochtli, and with the number 1; that which followed, Acatl, with the number two; afterward, Tecpatl, with 3; and then, Calli, with 4; and continuing to use the same four symbols in this order will give to Tochtli the number 5, to Acatl 6, to Tecpatl 7, and to Calli 8; and thus the reckoning is carried on through the cycle (or half a century), 52 years, but without counting them all progressively from one to fifty-two, but interrupting the count when one arrived at thirteen; and in this

manner they divided the circle, or wheel of the cycle, into four tri-decades of years, whose figures and symbols they represented in an inverse order to that which we practice in our writings—commencing theirs on the right hand, and proceeding toward the left, a fashion which they practice in all their picturegraphs. To each of these indictions, or tri-decades of years, they gave the name *Tlalpilli.*

6. Although this method of counting the years by periods of fifty-two was general in all the principalities and provinces of the kingdom of Mexico, and the symbols and order of placing them was also the same, all did not commence to count their cycle by the same year. The Toltecs began it with Tecpatl, the Teotihuacans with Calli, the Mexicans with Tochtli, and the Tezcocomos with Acatl; hence, there was a difference among these nations as to the time when they began the correction, and equalized the civil year with the solar tropical, of which we will speak hereafter; consequently, there not being the same date on which all bound up their years, there was a difference of several days in the reckoning of some nations when compared with others; but all knew well what was the difference, and they took account of it in their commercial treaties.

7. The Mexican cycle (or half century) is reckoned in this manner:

Mexican Cycle of Fifty-two Years.

1 TLALPILLI. OR INDICTION.		YEAR.	2 TLALPILLI. OR INDICTION.		YEAR.	3 TLALPILLI. OR INDICTION.		YEAR.	4 TLALPILLI. OR INDICTION.		YEAR.
(1)	Tochtli,	1	1	Acatl,	14	1	Tecpatl,	27	1	Calli,	40
2	Acatl,	2	2	Tecpatl,	15	2	Calli,	28	(2)	Tochtli,	41
3	Tecpatl,	3	3	Calli,	16	(3)	Tochtli,	29	3	Acatl,	42
4	Calli,	4	(4)	Tochtli,	17	4	Acatl,	30	4	Tecpatl,	43
5	Tochtli,	5	5	Acatl,	18	5	Tecpatl,	31	5	Calli,	44
6	Acatl,	6	6	Tecpatl,	19	6	Calli,	32	6	Tochtli,	45
7	Tecpatl,	7	7	Calli,	20	7	Tochtli,	33	7	Acatl,	46
8	Calli,	8	8	Tochtli,	21	8	Acatl,	34	8	Tecpatl,	47
9	Tochtli,	9	9	Acatl,	22	9	Tecpatl,	35	9	Calli,	48
10	Acatl,	10	10	Tecpatl,	23	10	Calli,	36	10	Tochtli,	49
11	Tecpatl,	11	11	Calli,	24	11	Tochtli,	37	11	Acatl,	50
12	Calli,	12	12	Tochtli,	25	12	Acatl,	38	12	Tecpatl,	51
13	Tochtli,	13	13	Acatl,	26	13	Tecpatl,	39	13	Calli,	52

So that in the first indiction, the symbol Tochtli is found to be accompanied with the numbers 1, 5, 9 and 13; in the second,

with 4, 8 and 12; in the third, with 3, 7 and 11, and in the fourth, with 2, 6 and 10.

The same thing happens with the rest of the symbols that begin the other three indictions; hence, we deduce the following rules: Each indiction finishes with the same symbol with which it begins; and it occurs four times in the first and three times in the others. Always when the numerical characters accompanying a symbol are 1, 5, 9 and 13, the period will be the first of the same indiction as the symbol; but it will be otherwise if the numbers are different, which, compared with those that are arranged in our table, will make known what indiction it must be. And thus it will be easy to ascertain whatever year is referred to separately, and to what indiction it belongs, and, consequently, how many have elapsed since the commencement of the Mexican cycle.

Although the Mexicans commenced their cycle with the symbol "ce Tochtli"* (first rabbit), they did not prefer it, but the following year, "ome Acatl" (second cane), upon which they held the grand festival of fire, which they celebrated in honor of their secular gods, and it endured for thirteen days, as we have previously stated. In all their picturegraphs we see the hieroglyphic of the "binding of the cycle," with the symbol "ome Acatl;" and in all their annals and manuscript documents their authors expressly relate that on this year they bound their cycles and rekindled the sacred fire. A long time elapsed before I could ascertain the reason for this alteration, until there fell into my hands the "Mexican Chronicle," written by Don Hernando de Alvarado Tezozomoc. By it there is clearly demonstrated the cause that led to the change in the order of reckoning which they had received from their ancestors, the Toltecs (who commenced their cycle with the symbol "ce Tecpatl," and had transferred the celebration of their secular festival to the year "ome Acatl.") The grand epoch of the Mexicans was that on which they made their exodus from Aztlan, their country, in order to come and populate the lands of Anahuac; and this was in the year "ce

*The Mexican numbers are: Ce, 1; Ome, 2; Tei, 3; Nahui, 4; Macuilli, 5; Chicuacem, 6; Chicome, 7; Chicuei, 8; Chicuhnalmi, 9; Matlacti, 10; Matlacti oz ce, 11; Matlacti omome, 12; Matlacti omey, 13.

Tecpatl," corresponding to the year 1064 of the Christian era; but as the most of the year had passed, and the remainder was spent in wanderings, without making any settlement, until the year "11 Acatl" (1687), when they arrived at "Talisco," otherwise called "Acahualtzinco," where they remained for nine years, in which occurred the "ce Tochtli," which became the origin of the indiction, and they corrected their time, and began from it to reckon their cycle by the order of Chalchinhtlatonac, who was then their leader; but out of respect for their principal commander, Huitzilopochtli, whom they subsequently adored as the god of war, they transferred "the festival of fire" and "the binding of the years," on Xiuhmolpia, to the following "ome Acatl," because, in that year, Huitzilopochtli was born, on the day ce Tecpatl, as has been determined by the said author.

And in this region of Tlalixco their years were bound anew, and the first time of their new reckoning made, as is declared also by Chimalpain and others; and in the subsequent cycles, and in the places where they completed them, one finds in their pictures the hieroglyphic of "the binding," which is a handful of reeds tied together with numerical characters, to show how many years had elapsed, or how many festivals of fire were yet to come after that which they had celebrated in Tlalisco, or Acahualtzinco — the year "ome Acatl," corresponding to 1091 of the Christian era. Thus matters are determined in the same manner by the manuscripts of the Indian authors.

8. The epoch of the Mexicans, as has been stated, was the year "ce Tecpatl," but the beginning of their cycle was "ce Tochtli," which is the origin of the indiction, although a species of religious ceremony was consecrated to the honor of Huitzitopochtli, the year following "ome Acatl," celebrating in it the secular feast of Xiuhmolpia; hence, result two things, which it is necessary to notice, in order to obtain a perfect comprehension of the time alluded to in their histories. The first is, that having completed a cycle when they made their first festival at Tlalixco, and reckoning them in relation with the number of cycles, or Xiuhmolpille, since this festival (which was on the time they corrected their years, and determined to reckon them from the "ce

Tochtli") in order to find accurately the number of years in their histories, you must substract one unit from the number of "bindings of years," and multiply the remainder by 52, and you will have exactly the number of years elapsed from the first festival to the last Xiuhmolpilli.

The second thing is that, having commenced to count their first cycle after twenty-six years had elapsed from their exodus from Aztlan, which is their epoch, in order to find any particular year referred to in their histories, or of any special events, to the product of the cycles completed, reckoning from "ce Tochtli," you add, besides the passed years of the following cycles, the twenty-six which has elapsed since the exodus from Aztlan, and the sum will be the number of years reckoned from their epoch. For example, in the year "ce Acatl," the year in which the Spaniards entered Mexico, which was the first of the second indiction after the ninth "Xiuhmolpia," you will ascertain those that have elapsed since their epoch. If, to the product 416 of the 8 completed cycles, you add the 13 years that have elapsed of the first following indiction and the 26 years that have passed since the exodus from Azatlan until the first *Xiuhmolpia*, there results 455 years which have elapsed from the Mexican epoch to the arrival of the Spaniards, which sum, substracted from 1519 of our calendar, gives for the exodus from Aztlan the year 1064 of the Christian era, as has already been stated. $416+13+26=455$. $1,519-455=1,064$.

9. Each one of the years of their civil period consisted of 365 days, a distinction from the solar tropical year of 365 days, 5 hours, 48 minutes and 50 seconds; hence, this excess of almost 6 hours makes in each quadrennial the retrocession of one day in the commencement of the year.

At the end of 52 years the retrocession would amount to 13 days, which they knew perfectly well, and, in order to make the correction, they added to the last year, not precisely that number, but only 12½ days, as is clearly proved in the history of their chronology, and, consequently, 25 complete days at the end of their grand cycle of 104 years, which correction appears to be the most exact of any that has been invented in order to reduce the

civil to the solar years, since the small excess of 4 hours, 38 minutes and 40 seconds that there is over the 25 days, in a period of 104 years, will not amount to one entire day until the completion of more than five of these great periods, or 538 years, in which time the civil year will recede only one day from the solar year. Some historians, convinced by the close approximation which the days of the Mexicans had with ours in the later years of the conquest, concluded that one day was added in each quadrennial, like our bissextile, founded on a particular festival which they celebrated every four years; but this was a manifest error, for this feast was celebrated in honor of rekindling the fire every year, and to it they gave especial veneration under the title of "*Xiuhteuctli*," the lord of the year. They celebrated it with the greatest solemnity when the same symbol returned with which they commenced the first "tricena" (tricene) of their cycle, which was, as we have seen, every four years. They had, notwithstanding, perfect knowledge that in each one of these intervals they were losing a day, which is evident from this same stone that we are going to describe; but the correction was not made until the end of the cycle (of 52 years), when they intercalated in one group the 13 days which they spent in festivals in honor of their secular gods, one of whom was this same "*Xiuhteuctli Tletl.*"

10. Each one of the 18 months that composed the year was made up of 20 days, which they reckoned consecutively from 1 to 20; and, in order to refer to any date, they spoke of the day, of such a number, of such a month, just as we say, the 13th day of May, without stating the day of the week corresponding. for each one of those 20 days had its symbol and particular name, including among them the same four symbols with which they designated their years. Of their 20 symbols, they formed another species of calendar, which was used by the priests and principal people.

The first calendar contained 18 months that were called "Tonalpohualli;" that is, "reckoning of the sun," or days, or "Cempohualilhuitl," feasts of 20 days; when they celebrated one especial festival at the end of each of these months, it was purely solar. But the second, in which figured the symbols of the day, corresponded to the apparent movements of the moon, and they

called it "Metztlapohualli;" that is, the "reckoning of the moon." And because they used it for the feasts which they celebrated daily for their divinations and for other superstitious rites, they gave it various other names; and, hence, in one of these same calendars it is called "*Cemilhuitlapohualliztli,*" "count of the ritual feast," and, in another of the highest superstition, was named "Tonalamatl," which literally signified nothing more than "decree of the sun," or of the days; but it possessed an allusion to the influences of the planets, although this species of calendar is described and represented in a distinct form and manner.

11. The numbers of the 18 months of the first calendar were varied in applying them to the purposes for which they were prepared, or to the seasons in which they occurred, or to the customs of the other Pueblos subjected to the Government of Mexico, and this variety in numbering them occasioned the great confusion which the writers about them fell into, thus, in regard to the order of arranging them as to their legitimate and primitive numbers, and likewise in regard to the figures by which they were symbolized; hence originated some apocryphal representations of this first calendar, and doubts as to which was the first month of the year, upon which matter we will not delay at present, reserving for hereafter to explain it all. We will only give notice, in passing, that one of the apocryphal calendars is that which you find at the beginning of the "Cortez Letters," which were printed in Mexico in 1770, under the title of "History of New Spain," written by its illustrious conqueror, Hernan Cortez, in which engraving, is represented the five days of the "nemontemi," contrary to the system observed by the Mexicans, who made use of them only for the correction of their time, and could not represent them in their calendars without interrupting the invariable arrangement of their months, and on that account some of the historians expressly assert that they were not included in their calendars. The truthful and legitimate representation is the one you find engraved by Dr. Gemelli in his book called "Giro del Mundo," revolution of the earth, copied from one given him by D. Carlos de Sigwenza, as we will see at the proper time.

12. The symbols and hieroglyphics which designated the 20 days were the following:

1. Cipactli—sea animal.	11. Ozomatli—ape (female).
2. Ehecatl—wind.	12. Malinalli—twisted plant.
3. Calli—house.	13. Acatl--cane.
4. Cuetzpalin—lizard.	14. Ocelotl—tiger.
5. Cohuatl—serpent.	15. Quauhtli—eagle.
6. Miquiztli—death.	16. Cozcaquauhtli--Mexican eagle.
7. Mazatl—deer.	17. Ollin—sun's movements.
8. Tochtli—rabbit.	18. Tecpatl—flint.
9. Atl—water.	19. Quiahuitl—rain.
10. Itzcuintli—dog.	20. Xochtli—flower.

Of these 20 days they composed their second calendar with such a disposition that they formed out of them a period of 260, not reckoning them from 1 to 20, as in the months of the first calendar, but from 1 to 13, and in this manner they divided the 260 days into 20 "tridecnas," which were after the fashion of our weeks, that each of these days carried with it its numerical character, in order to distinguish the symbols of one set of tridecnas from those of the others wherein they were repeated. These tridecnas represented the daily movements of the moon from east to west, from the time of conjunction until a few days after full moon, which interval of time, while, if it appeared at night above the horizon, is named *Ixtozoliztle*, or "watching," and after, when it begins to be hidden at night, until near conjunction, when it is visible by day in the heavens, it is called *Coehliztli*, or "sleeping," as they supposed it then slept at night. By the combination of these tridecnas and the solar cycle of 52 years, they formed a semi-solar period, most exact, for the purposes of astronomy, at the end of which you find verified the similar celestial phenomena which depend upon the movements of the sun and the moon, as the conjunctions, quadratures, oppositions and eclipses of both planets, whose period is contained in a species of calendar that was obtained by P. Fr. Diego Valdes, but he does not explain anything about it. In my work already referred to, I demonstrate the exactitude of this period, and give an extensive explanation of it, verified by eclipses that have been observed in the years passed, as well as those calculated for the future.

13. As the solar year consists of 365 days, and this calendar does not contain more than 260, some authors thought, and among them Torquemada, that it was merely a superstitious contrivance; but those who succeeded in discovering the exactitude it contained, eulogized the reckoning as ingenious, and esteemed it as a calendar of astronomy and chronology. The use of it was not known to the common people, but was understood only by the educated men and the priests, who used it in their religious rites, and in order to announce to the people the days appointed for their principal festivals. Its arrangement was in the following form:

1. Ce Cipactli.	1. Ce Ocetotl.
2. Ome Ehecatl.	2. Ome Quanhtli.
3. Yei Calli.	3. Yei Cozca quanhtli.
4. Nahui Cuetzpalin.	4. Nahui Ollin.
5. Maculi Cohuatl.	5. Macuili Tecpatl.
6. Chicuace Miquiztli.	6. Chicuace Quiahuitl.
7. Chicome Mazatl.	7. Chicome Xochitl.
8. Chicuei Tochtli.	8. Chicuei Chipactli.
9. Chicuhuahui Atl.	9. Chicuhuahui Ehecatl.
10. Matlactli Itzcuintli.	10. Matlactli Calli.
11. Matlactli once Ozomalli.	11. Matlactli once Cuetzpalin.
12. Matlactli omome Malinalli.	12. Maclactli omome Cohuatl.
13. Matlactli omey Acatl.	13. Matlactli omey Miquiztli.

And in the same manner you continue the other sets of thirteen days until you have formed twenty groups without encountering in all of them a similar symbol with the same number, and, as the first of these symbols is "Ce Cipactli," agrees always with that of the first day of the common solar year. In the first thirteen months that enter into the 260 days of the period, there is no need for persons who are instructed to refer to these dates by the number of the days of any of those months, but to designate the number and the symbol in the set of thirteen that corresponds. And in this form I have a history, in the Mexican language, with its figures and numerical characters, of the peregrinations which were made by the Toltecs Icxicohuatl and Quetzaltehueyac, copied from that which Boturini refers to, in the first volume of the catalogue of his museum, wherein are designated the years with their appropriate figures and the symbols of the days on which the incidents happened that are there related, together with the numerical characters that correspond to them.

14. As the first twenty trecenas *i. e.*, $20 \times 13 = 260$, do not contain more than thirteen months of the "first calendar," or 260 days, in order to complete the year of 365 days one must commence the reckoning of the (14th) fourteenth month with the same symbol and number, "Ce Cipactli," and run over the other five months and five days ($20 \times 5 + 5$), or 105 remaining days, repeating the same symbols and numbers of the first eight trecenas, the last of the five Nemontemi agreeing with the symbol "Ce Cohuatl," the first of the ninth trecena. But as the repetition of the same symbols and numbers would lead to confusion, as one could not tell whether you referred to the first thirteen months of the solar year, or to the last five, when you began to repeat the same symbol and numbers as in the first eight trecenas, they distingushed the last 100 "useful days" by using additional symbols, which they called "companions," and which they named jointly with those of the days already elapsed. So by this method one could not mistake, or doubt, as to the time of the year, on account of confusing them with the symbols and similar numbers of the days referred to in the arrangement of the "Second Calendar," or lunar cycle.

15. In order to fully understand this subject, one must take note that to each one of the symbols of the days the Indians imagined a special power over the day to which it belonged, and they made a special festival, and attributed to it a peculiar influence over sublunary affairs, just as signs and planets are supposed to possess in systems of astrology. But it was not only to the symbols of the day that they attributed this domination. They divided these influences also among the nocturnal signs, some of which had the same names and the same figures as the days, but they distinguished them by a certain device, which denoted that they were elevated to a higher dignity. Imagining to the first the rule from midday until midnight, and to the second, from midnight to the following midday; and to the figures that represented the second, they gave the title of "Companions," or "Lords of the night." There were nine, and they were distributed consecutively according to the order, which will be described, through the whole of the series of 260 days, or the twenty "trecenas." To these they

affixed no numerical character, and they were distinguished only by the order which they maintained (which was never altered in this calendar, unless it was in the "*Tonalmatl,*" in which the priests were accustomed to transfer some particular festival, in order to make it agree with some other, or for some special motive; but except for some such interruption, they continued in the same order as they commenced), as to the numbers that accompanied the symbols of the days.

The Indians regarded the "nine companions" with such consideration, as to bestow a special designation, the title of Quecholli which is the name of a bird of rich and beautiful plumage, that was held by them in great estimation, and they dedicated an entire month to its name. It was the symbol of lovers, and they invoked it at weddings, with epithalamiums, just as the Romans invoked Hymen. The names and the order of the nine companions are as follows:

Xiuhteuctli—*Tletl,* fire, Lord of the year.
Tecpatl—Flint.
Xochitl—Flower.
Cinteotl—Goddess of maize, or Ceres.
Miquiztli—Death.
Atl—Water, symbol of the Goddess *Chalchiuheueye.*
Tlozolteotl—Goddes of love, or Venus.
Tepeyototli—Goddess of the center of mountains.
Quiahuitl—Rain, symbol of the God *Tlaloc.*

16. Senor Boturini makes mention of these "Lords of the night," but he confuses them with another set of "companions" which was added by the Judicial Astrologers in the *Tonalamatl,* and it is to be wondered at since he had the original representation of this species of the superstitious calendar called "*The Ritual,*" and quoted it in § 30, number 2, of the Museum Catalogue, where you find the two sets of "companions" with the days of the "trecenas;" he did not know how to discriminate between those which were Lords of the night, and those signs which the Indians used for their false divinations, and heathen prognostications, and he has greatly confused the whole matter; although it is sufficiently difficult to comprehend perfectly this species of calendar, for it con-

tained in itself not only the catalogue of their idolatrous festivals, but also a multitude of superstitions, about which but very little mention has been made by the Indian Historians. In my work already mentioned, I give an explanation of the most important matter it contains, with an exact copy, which I had made of it, to which I have added two plans, that are not to be found in the original. The numbers and order of the nine companions, are the same as described by Don Christoval del Castillo, or Nehuatl Nicnotlacotl, a Tezcocano, an Indian who wrote in the Mexican language, a most erudite history of the migrations of his nation and of the conquest made by the Spaniards. He arranged them as is herewith shown, and they correspond to those which were figured in the first series after the hieroglyphics of the days of the "Tonalmatl."

TONAL.	QUECHOLLI.
1. Cipactli.	Xiuhteucli Tletl.
2. Ehacatl.	Tecpatl.
3. Calli.	Xochitl.
4. Cuetzpalin.	Cinteotl.
5. Cohuatl.	Miquiztli.
6. Mizquiztli.	Atl.
7. Mazatl.	Tlazolteotl.
8. Tochtli.	Tepeyoltotli.
9. Atl.	Tlalloc Quiahuitl.
10. Itzcuintli.	Tletl.
11. Ozomatli.	Tecpatl.
12. Malinalli.	Xochitl.
13 Acatl.	Cinteotl.

In this manner we see the days of this calendar accompanied with the symbols of the night, which serve to make known to what month of the year belong the days of the first eight trecenas which are repeated; because, when you would refer to some day that coincides in the first thirteen months of the first calendar, that is within the period of 260 days, with the second, there is no need to mention its "companion," but when the date in the 260 has passed, and it belongs to the last five months of the calendar, and in that case you see repeated the same symbols and numbers as in the 260, this is applied, for the purpose of discrimination, and as the "companion" in those five months properly corresponds, in this way is made known exactly the day of the solar month in question without the

necessity of numbering it; besides, as the "companions" were nine only, and the days of this calendar 260, they could not complete the period, and it was exceeded by one, which was Quiahuitl, which was in the ninth reckoning that they formed in order to harmonize it with the solar, that now happens to accompany "Cipactli," which in the beginning of the year was accompanied by "Tletl," and thus, though the same symbols and numerical characters were repeated, the "companions" that corresponded to the last five months were different. And for this reason some of the Indians never failed to quote them in their histories, to exalt the elegance of their narration, by the mention of the symbols of the days, conjointly with their "companions," that were referred to the first eight "trecenas," and which belonged also to the first five solar months, and also in the last with which they completed the year. We find this method occurring numerous times in the writings of Christoval Castillo.

17. In addition to the figures that represent the days, and the Lords of the night, you find in the Tonalamatl (and the said Castillo makes especial mention of them in treating of this second calendar), other figures which are placed in the principal angles of greater magnitude and with the entire figure represented; these are referred to by Boturini, in the said § 30, number 2, of the catalogue of his Museum. They represent the God that the Mexicans worshiped, and gave place to by pre-eminence, among the planets and celestial signs, attributing to them greater and more extensive powers than to the rest, not limiting it to a single day or night, but to the whole "trecena," which respectively corresponded to them; either alone, or accompanied with some of the same planets; endowing them also with all the appropriate powers they could imagine. One of these celestial signs was the statue, or idol (a figure combined of the God Huitzilopochtli and the Goddess Teoyaomiqui, war idols) which we may describe hereafter.

CATALOGUE OF THE SPECIMENS

IN THE

COLLECTION

OF THE

CINCINNATI SOCIETY of NATURAL HISTORY.

COMPILED BY

JOSEPH F. JAMES, CUSTODIAN,

Assisted by the Curators of the Various Departments.

THE following catalogue has been prepared in accordance with the instructions of the Executive Board of this Society. The present part, Mollusca, embraces, as far as they are known, the land, fresh water and marine shells belonging to the Society. It makes no pretense beyond being a list, and is arranged alphabetically for convenience of reference.

The most of the shells here catalogued are arranged in flat glass cases in the third story of the building of the Society. They are all numbered and labeled; besides the numbered list, there is a card catalogue giving the name, the locality and the donor, as far as can be done. This card catalogue is accessible to all, and by its means can be ascertained, in a few minutes, whether any particular shell is in the collection. This printed list will now supplement the written card catalogue.

The main object in the printing of this list is to enable the members and friends of the Society to see what is on hand and what is lacking. In some genera many species are represented. For instance: *Unio*, *Helix*, *Cypræa*, *Achatinella*, *Partula*, *Melania*, etc.

At present the collection, as arranged, follows as nearly as possible "Woodward's Manual of the Mollusca." Many improvements could be devised for the better display of the specimens, but lack of room is a serious obstacle and except in the Unionidæ, series of specimens are not attempted. Large series are interesting to

the student, but for the general public a selection of a few of each species is all-sufficient.

The attention of the members and friends of the Society is invited to this catalogue. Donations of desiderata are solicited, and exchanges will gladly be made for desired species. The numbers prefixed to the names indicate the number of specimens of each. Exchanges will be made whenever the number of specimens will warrant it.

J. F. J.

MOLLUSCA.

Acavus.
2 lactea, Müll.
4 Phœnix, Pfr.

Achatina.
10 fasciata, Müll.
2 fasciata, var.
2 pulchra, Linn.
1 variegata, Lam.
5 versicolor, Brod.

Achatinella.
2 abbreviata, Rve.
2 affinis, Newcb.
2 biplicata, Newcb.
2 bulimoides,
2 citrina, Migh.
3 colorata, Rve.
2 crassa, Newcb.
3 fulgens, Newcb.
5 fumosa, Newcb.
2 glabra.
2 magna, Adams.
2 Mighelsiana, Pfr.
2 mustelina, Migh.
2 nucleola, Gould.
3 obscura.
2 plicata, Migh.
2 producta, Rve.
3 reticulata.
2 rosea.
3 rubiginosa.
2 rugosa, Rve.
2 spirozona, Fér.
3 splendida, Newcb.
1 tessellata, Newcb.
3 tristis, Fer.
2 turritella, Fer.
3 variegata, Fer.
3 venusta, Migh.
4 veridans, Migh.

Acmæa.
5 patina, Esch.
8 pelta, Esch.

Acmæa.
5 persona, Esch.
2 scabra, Mull.
3 spectrum, Mull.
10 testudinalis, Han.

Adula.
2 stylina, Cpr.

Ælexia.
6 setifer.

Amnicola.
2 Cincinnatiensis, Anth.
22 longuinquas.
5 lustrica, Say.
5 pallida, Haldeman.
5 porata, Say.

Amphissa.
8 corrugata, Reeve.
4 versicolor.

Amycla.
7 carneata, Huds.
10 gansapata, Gould, var. Californica.

Anachis.
17 avara, Perkins.

Ancillaria.
1 glabrata, Sowb.
2 ventricosa, Lam

Anculosa.
18 Ampla, Anth.
1 Anthonyi, Redfield.
5 carinata, Say.
1 costata, Pfr.
5 dissimilis, Say.
1 picta, Con.
15 plicata, Con.
3 præœrosa, Say.
19 umbilicata, Weth.

Ancylus.
4 fuscus, Adams.
1 rivularis, Say.

Angitrema.
9 angulata, Wetherby.

Angitrema.
4 parva, Wetherby.
7 Whealteyi, Tyron.
Anodonta.
5 Californienses, Lea.
? cataracta, Say.
1 corpulenta, Coop.
5 cygnea, Drap.
25 edentula, Lea.
16 Ferussaciana, Lea.
1 Footiana, Lea.
1 grandis, Lea.
6 imbecilis, Say.
? lata-marginata, Lea.
2 Lewisii, Lea.
4 Oregonensis, Lea.
4 pavonia, Lea.
11 plana, Lea.
2 Salmonia, Lea.
3 subcylindrica, Lea.
2 suborbiculata, Say.
9 undulata, Lea.
2 Wahlematensis, Lea.
6 Wardiana, Lea.
Anomia.
3 aculeata, Gmel.
1 ephippum, L.
25 glabra, Verrill.
4 lampa, Gray.
Apollon.
2 gyrina, Linn.
Aporrhais.
1 occidentalis, Beck.
2 pes-pelicani, Lam.
Arca.
1 granulosa.
1 incongrua, Say.
1 pexata.
3 semitorta, Lam.
Argonauta.
2 argo, Linn.
Arionta.
3 (Helix) Gabbi, Newc.
1 (Helix) intercisa, Binney.
2 (Helix) ramentosa, Gould.
3 (Helix) Stearnsiana.
2 (Helix) Traski.
Astarte.
4 castanea, Say.
2 undata, Gould.
Astyris.
24 lunata, Dall.
Atys.
2 naucum, L.
Auricula.
1 auris-Medæ, Linn.
2 myosotis, Drap.
Avicula.
1 crocea.
2 hirundo, L.
Axina.
1 Zebuensis, Brod.
Barleeia.
16 subtenuis, Cpr.
Bithum.
20 nigrum, Stimpson.
Buccinum.
4 undatum, L.
Bulimus.
1 acutus, Brug.
2 aurantium, Carp.
2 daphius, Brod.
10 dealbatus, Say.
5 (Stenogyra) decollatus, Drap.
3 (Liostricus) Dorman. W. G. B.
4 elongatus.
5 fulguratus, Jay.
1 hæmastomus, Scop.
4 Guadaloupensis, Fer.
7 hypnorum, Drap.
4 istoma, Sowb.
1 Keroensis, Garrett.
1 lubricus, Brug.
1 malleatus, Jay.
3 megasoma, Say.
4 montanus, Drap.
3 Mooreanus.
1 oblongus, Brug.
7 radiatus, Lam.
20 (Bulimulus), Scheideanus.
1 Seemanii, Dohrn.
3 zebra, Oliv.
Bulla.
29 ampulla, Linn.
10 nebulosa.
6 occidentalis, Adams.
2 striata, Brong.
3 (Haminea) virescens, Sowb.
Bullia.
1 monilifera, Val.
2 vittata, Linn.
Bysso-arca.
2 zebra, Sw.
Calliostoma.
4 (Trochus) annulatus Mach.
4 costatum, Mart.
Callista.
6 Dione, Linn.
Cancellaria.
3 cancellata, Lam.
7 reticulata, Lam.
Canidaria.
10 oniscus, Lam.
Canistrum.
2 perversum, Linn.

Capsa.
1 lævigata.
Cardium.
3 citrina.
3 corbis, Mart.
3 costatum, L.
2 edule, Linn.
1 hemicardium, L.
1 muricatum, Linn.
16 pinnulatum.
1 retusum, L.
2 substriatinum, Con.
Carelia.
4 adusta, Jacq.
Carveolla.
1 elegans.
Casmaria.
1 Ceylonica, Lam.
Cassidaria.
4 echinophora, Lam.
1 tyrrhena, Lam.
Cassidulus.
3 corona, Gmel.
3 melongena, Linn.
Cassis.
5 areolata, Brug.
1 canaliculata, Lam.
2 erinaceus, Brug.
1 flammea, Brug.
1 glauca, Brug.
7 rufa, Brug.
2 saburon, Brug.
5 sulcosa, Brug.
4 testiculus, Brug.
7 vibex, Brug.
2 zebra, Lam.
Cerastisolen.
1 cynumen.
Certhidea.
27 saccrata, Gould.
8 scalariformis, Say.
Cerithium.
7 aluco, Brug.
9 asper, L.
4 atratum, Gm.
3 baccatum, Kiener.
4 eriense, Val.
2 fluviatile, Potiez.
20 granosum, Kiener.
4 muricatum, Brug.
10 muscarum, Say.
5 nigrescens, Menke.
2 nodulosum, Lam.
8 obeliscus, Brug.
3 obtusum, Lam.
12 septemstriatum, Say.
25 sterco-muscarium.
1 sulcatum, Brug.
Cerithium.
6 vertagus, Brug.
Cerostoma.
3 Nuttallii, Con.
Chione.
2 simillima, Sowb.
Chiton.
2 Magellenicus, Ch.
Chlorostoma.
2 aureotinctum, Fost.
2 brunneum, Phil.
16 funibrata, Ag.
Chelyconus.
2 raphanus, Brug.
Chrysodomus.
3 dirus, Rve.
Cionella, (Ferussacia).
40 subcylindraceus, L.
Circe.
2 dispar, Desh.
3 rugifera, Lam.
Cistula.
5 catenata, Gould.
Clausilia.
2 cœrulea, Fer.
1 excrata, Menke.
2 marmenata, Muhl.
Clidiophora.
3 trilineata, Carp.
Cochlostyla.
1 Tucanensis, Pfr.
2 volubilis, Reeve.
Codackia.
2 tigrina, Lam.
Columbella.
6 fulgurans, Lam.
4 fuscata, Sowb.
3 Hebræ.
2 major, Sowb.
2 mendicaria, Lam.
40 mercatoria, Linn.
8 ocellata.
2 pardalina, Lam.
25 rustica, L.
3 strombiformis, Lam.
8 Terpsichore, Leath.
Concholepas.
6 Peruviana, Lam.
Conus.
1 araneosus, Brug.
4 Archiepiscopus, Brug.
1 betulinus, Linn.
6 Californicus, Hds.
2 catus, Brug.
20 echinulatus, Keiner.
2 episcopus, Brug.
1 floridanus.
5 fustigatus, Brug.

Conus.
1 generalis, L.
1 genuanus, Linn.
6 geographicus, Linn.
5 (Colonaxis) Hebræus, L.
2 Largillierti, Kiener.
4 lentigonsus, Reeve.
3 leonis.
5 litterratus, Linn.
1 (Rhizoconus) Maldivus, Brug.
3 marmoreus, Linn.
4 miles, Linn.
5 millipunctatus, Lam.
1 mussatella, Brug.
2 (Rhizoconus) mustellinus, Brug.
1 nodiferus, Kiener.
5 pulicarius, Brug.
2 regius, Chemn.
5 striatus, Linn.
1 suratensis, Brug.
7 (Lithoconus) tessallatus, Brug.
5 (Lithoconus) testudinarius, Lam
6 tulipa, Linn.
3 turdus-muscarius.
5 Virgo.

Corasia.
2 lais, Pfr.
2 Valenciennesii, Egd.

Corbis.
3 fimbriata, Lam.

Corbula.
2 luteola, Cpr.

Crassina.
6 elliptica.

Crepidula.
2 adunca, Sowb.
5 convexa, Say.
5 dorsata, Brod.
9 fornicata, Say.
2 lingulata, Gld.
6 plana, Say.
4 rugosa, Nutt.

Crucibillum.
3 spinosum, Sowb.

Cryptochiton.
1 Stellersi, Midd.

Cryptogramma.
2 flexuosa, Lam.

Cucullea.
2 auriculiferæ, Lam.

Cuma.
2 Kiosqueformis, Duclos.

Cyclas.
1 calyculata, Drap.
2 similis, Say.
4 sulcatum.

Cyclophorus.
1 involvulus, Mull.

Cyclophorus.
2 punctatus, Grub.
3 tigrinus, Sowb.
2 Woodianus, Lea.

Cyclostomus.
3 angustus, Adams.
1 auritus, Zeig.
2 Banksianus, Sowb.
5 Blandianus, Adams.
6 crenulosus, Adams.
8 elegans, Mull.
4 fasciatus, Gray.
1 fimbriatus, Sow.
1 flavulus, Lam.
4 granosus, Adams.
4 Hillianus, Adams.
3 hyacinthus, Adams.
4 igualabrus, Adams.
2 Jamaicensus, Gray.
4 Jayanus, Adams.
7 maculatus, Drap.
2 patulus, Drap.
1 scabriculus, Sow.
3 striolatus, Pers.
25 sulcatus, Drap.
6 variabilus, Adams.

Cyclotus.
3 planorbulum, Lam.

Cylindrella.
2 brevis, Pfr.
2 gracilis, Wood.
3 Mangeri, Wood.
5 rosea, Pfr.

Cypræa.
15 achatina, Solander.
2 alboginosa, Gray.
5 amethystica, Linn.
2 annulata, Gray.
10 annulus, Linn.
11 Arabica, Lam.
3 Arabicula, Lam.
3 argus, Linn.
19 arenosa, Gray.
2 arrosa.
9 asellus, Linn.
1 aurantium, Martyn.
3 (Trivia) Californica, Gray.
29 caput-serpentis, Linn.
27 carneola, Linn.
8 var.
11 caurica, Linn.
2 cervinetta, Kien.
2 cervus, L.
6 (Trivia) Childreni, Gray.
3 cicercula, Gmel.
1 clandestina, Linn.
4 coccinella, Lam.
4 cribaria, Linn.

Cypræa.
3 cylindrica, Bon.
2 divacea, Lam.
2 eburna, Barnes.
32 erosa, Linn.
5 errones, Linn.
11 (Trivia) Europœa, Mft.
15 exanthema, Linn.
3 felina, Gmel.
4 fimbriata, Gmel.
1 flaveola, L.
2 gangrenosa, Solander.
3 (Trivia) gemmula, Gould.
14 globosa, Gray.
14 helvolo, Linn.
1 hirundo, Linn.
1 histrio, Gmel.
2 Indica.
2 intermedia, Kiener.
23 Isabella, Linn.
4 limacina, Lam.
5 lurida, Linn.
32 lynx, L.
6 Maculata.
2 mappa, Linn.
6 mauritiana, Linn.
8 moneta, Linn.
3 mus, Linn.
10 nucleus, Linn.
8 obvelata, Lam.
3 ocellata, Linn.
20 oniscus, Lam.
2 onyx, Linn.
4 (Trivia) oryza, Lam.
2 pantherina, Soland.
16 pediculus, L.
2 picta, Gray.
2 pilula, Kiener.
2 poraria, Lam.
4 pustulata, Lam.
1 pyrum, Gmel.
3 quadri-maculata, Gray.
4 radians, Lam.
1 reticulata, Martyn.
4 rotunda, Kiener.
4 sanguinolenta, Gmel.
10 scurra, Chem.
3 (Trivia) Solandri, Gray.
2 staphylæa, Linn.
4 stercoraria, Linn.
2 tabesceus, Solander.
25 talpa, Lam.
4 testudinaria, Linn.
20 tigris, Linn.
1 turdus, Lam.
5 undulata, Solander.
2 ursellus, Gmel.
3 variolaria, Lam.

Cypræa.
6 vitellus, Linn.
3 zigzag, Linn.
Cypræovula.
2 capensis, Gray.
Cyrena.
1 Bengalensis.
1 Caroliniana, Bosc.
Cyprina.
4 Islandica, Lam.
Cytherea.
1 erycina, Lam.
5 gigantea, Lam.
4 maculata, L.
1 pectinata, Linn.
1 scripta.
Delphinula.
2 distorta, Lam.
1 licineata, Lam.
Dentalium.
25 pretionum.
Discina.
2 concentrica, Lam.
Docina.
1 Dunkeri, Phil.
Dolium.
2 fasciatum, Lam.
3 galea (?), Lam.
5 maculatum, Lam.
3 olearium, Lam.
6 variegatum, Lam.
Donax.
2 assimilis.
3 Californicus, Con.
3 denticulata, Linn.
9 dentifera, Hanl.
Dorcasia.
3 (Helix) Berlanderana.
Dreissena.
3 polymorpha, Pallas.
Dumatocera.
5 vitrea, Lesson.
Eupleura.
4 Tampaensis, Con.
Eburna.
4 areolata, Lam.
1 Ceylondica, Lam.
2 Japonica, Rve.
3 spirata, Lam.
Entalis.
3 striolata, Simpson.
Eulima.
3 micans, Cpr.
Eurycœlon.
11 gibberosa, Lea.
20 lepida, Lea.
Euryparypha.
2 arabica, Roth.

Euryta.
3 aciculata, Hds.
Fasciolaria.
2 distans, Lam.
1 filamentosa, Lam.
2 granosa, Brod.
1 princeps, Sowb.
3 trapezium, Lam.
5 tulipa, Lam.
Ficus.
3 Dussumieri, Valenc.
4 reticulatus, Lam.
2 ventricosa, Sow.
Fissurella.
4 pustula, L.
5 volcano, Reeve.
Fusus.
2 articulatus, Lam.
7 circireus, Say.
5 filosus, Lam.
2 longissimus, Lam.
1 morio, L.
3 Syracusanus, L.
6 tuba, Gmel.
3 tuberculatus, Lam.
3 turriculus, Mont.
Galatea.
1 radiata, Gmel.
Gilia.
6 artilis.
Glaudina.
3 fusco-lineata.
1 parallela.
9 truncata, Say.
Glyphis.
2 aspera, Esch.
Gnathodon.
125 cuneatus, Gray.
Goniobasis.
7 ampla, Anth.
9 aterina, Lea.
12 carina-costata, Lea.
10 crebricostata, Lea.
17 cristata, Anth.
12 Cumberlandensis, Lea.
12 Deshaysiana, Lea.
3 Haysiana, Lea.
7 Hydei, Conrad.
10 macella, Lea.
9 nassula. Con.
12 nitens, Lea.
4 olivula, Con.
3 plicifera, Lea.
7 porrecta, Lea.
2 rubicunda, Lea.
17 sparus, Lea.
14 striato-plicata, Weth.
21 symmetrica, Hald.
Goniobasis.
9 Vanuxemensis, Lea.
16 varians, Lea.
3 Virginica, Gmel.
6 vitatella, Lea.
Gyralus.
4 parvus, Say.
Haliotus.
5 asinina, L.
5 Cracherodii, Leach.
Harpa.
3 articularis, Lam.
5 minor, Lam.
1 nobilis, Lam.
5 rosea, Lam.
7 vetricosa, Lam.
Helicina.
3 Adamsiana, Pfr.
5 agglutinans, Sowb.
2 aurantia, Gray.
3 cincta, Pse.
1 faba, Pse.
2 Hollandii, Adams.
2 neritella, Lam.
3 orbiculata, Say.
1 palliata, Sowb.
6 picta, Pse.
3 pisum, Phil.
2 rufescens, Pse.
3 solida, Pse.
24 submarginata, Gray.
7 tropica, Jay.
Helicodiscus.
4 fimbriatus, Weth.
8 lineatus, Say.
Helicophante.
1 falconaria, Reeve.
Helicostyla.
1 cocomelous, Pfr.
Helix—See Arionta, Dorcasia, Mesodon, Polygyra.
4 acetabulum, Pse.
2 acuta, Lam.
25 (Mesodon) albolabris, Say.
5 var, dentata.
2 var elevata.
2 algiera.
1 Anthoniana, Adams.
30 appressa, Say.
11 arbustorum, L.
5 arrosa, Gld.
18 aspersa, Muller.
2 auricoma, Fer.
4 auriculata, Say.
5 auriformis, Bland.
3 avava, Say.
4 Ayarsiana, Newc.
1 badia, Fer.

Helix.
2 barbigera, Redfield.
2 Bonplandii, Lam.
2 Bridgesii, Newc.
2 bucculenta, Gld.
1 bulbus, Morch.
4 Californiensis, Lea.
4 candissima, Drap.
5 cantianà, Montague.
6 Carpenteriana, Bland.
2 Carthusianella, Drap.
5 cellaria, Lam.
4 cereolus, Muhlfield.
2 Chamissoi, Pfr.
10 (Camæna) cicatricosa, Mull.
1 cincinnus, Sowerby.
4 circinata
1 citrina.
1 Clarkei, Lea.
9 clausa, Say.
9 Columbiana, Lewis.
5 conspecta, Bland.
1 cornea, Drap.
2 dentifera.
1 cpesareâna, (?) Fer.
3 Cumberlandiana, Lea.
5 devia, Gould.
9 (Polygyra) Dorfeuilliana, Lea.
1 Downieana, Blanc.
2 Dupithonarsi, Desh.
1 Edvardsi, Bland.
29 elevata, Say.
10 ericetorum, Pfr.
4 exarata, Pfr.
22 exoleta, Binney.
2 fabrifacta, Pse.
22 fallax, Say.
3 fastigans, L. W. Say.
2 febigera, Bland.
3 ficta, Pse.
2 fidelis, Gray.
17 fraterna, Say.
1 fruticum, Drap.
1 gaultereana.
5 griseola, Pfr.
5 hamastoma, Linn.
2 harpa, Say.
3 Hazardi, Bland.
22 hirsuta, Say.
1 hispida, L.
2 Hopetonensis, Shutl.
12 hortensis, Mull.
3 Huaheimensis, Pfr.
3 incarnata, Mull.
2 incerta, Drap.
18 inflecta, Say.
4 (Polygyra) Jacksoni.
4 jejana, Say.

Helix.
3 (Stenotrema) labrosa, Bld.
10 labyrinthica, Say.
1 lactea, Mull.
10 lapicida, Linn.
2 leporina, Gould.
3 Leaii.
1 Listeri, Gray.
4 loricatà, Gld.
1 lutescens, Alenke.
1 Mandarina, Gray.
1 major, Binney.
2 marginata, Mull.
2 marginella, Gmel.
2 maxillata, Gld.
3 Mayallii.
1 McMurrayi.
1 melanostoma, Drap.
9 Mitchelliana, Lea.
2 Mobilians, Lea.
19 monodon, Rucket.
1 monozonalis, Lam.
34 multilineata, Say.
1 muralis, Fer.
5 naticoides, Jenr.
21 nemoralis, Linn.
3 nemoralis, var. hybrida, Pocket.
3 Newberryana, W. G. B.
9 Nicilensis, Fer.
2 Nickliniana, Lea.
2 nitens, Migh.
2 nitida, Mull.
2 obstricta, Say.
1 obvoluta, Mull.
22 palliata, Say.
3 pallida.
3 patris, var.
13 Pennsylvanica, Green.
2 peracutissima, Adams.
1 personata, Mich.
4 pisana, Mull.
1 pomatia, Linn.
1 porphyritia.
2 postelliana, Bland.
4 probosidea.
22 profunda, Say.
20 pulchella, Mull.
7 (Polygyra) pustula, Fer.
4 reticulata, Pfr.
2 Rhodostoma.
9 Ræmeri, Pfr.
5 Roiseyana, Fer.
1 rotundata, Drap.
6 rufescens, Pennant.
7 Rugeli, Shutl.
7 (Polygyra) Sampsonii, Weth.
5 Sayii, Binney.
2 scuta, Pse.

Helix.
19 septemvolva, Say.
1 sequoicola, Cooper.
3 serpentina, Fer.
1 Simsonii.
5 spinosa, Lea.
12 stenotrema, Fer.
2 subrutila, Migh.
3 subtilis, Anton.
1 sylvatica, Fer.
2 Texasiana, Moricand.
25 thyroides, Say.
2 Townsendiana, Lea.
35 tridentata, Say.
3 Troostiana, Lea.
2 tridiculata, Binney.
13 uvulifera, Shutl.
8 vermiculata, Mull.
4 verticillata, Parr.
23 virgata, De Costa.
6 virgata, var submaritima.
6 vivia.
6 volvovis, Parreyes.
2 (Triodopsis) vultuosa Gld.
1 Wheatleyi, Bland.
1 (Gonostoma) Yatesi, J. G. C.

Hellisoma.
3 ammon, Gould.

Hemiplecta.
2 Nov-Hibernæ, Quoy.

Heterodonax.
2 bi-maculata, Linn.

Hinnites.
2 gigantea, Gray.

Hippopus.
3 maculatus.

Hydrocera.
3 bulimoides, Wom & Jacq.
2 elongata, Pse.
3 Huapeinensis, Pfr.
2 robusta, Pse.

Ianthina.
30 bifida, Nutt.
5 communis, Lam.

Ilyanassa.
17 obsoleta, Stimp.

Imperator.
5 imperialis, Chemn.

Io.
2 fluviatilis, Say.
3 spinosa, Lea.

Iopas.
5 sertum, Brug.

Ischnochiton.
2 Cooperi.

Isocardia.
1 cor, L.

Kalherina
2 tunicata, Sowb.

Lacuna.
2 pertusa, Con.
7 vincta, Turton.

Leptothyra.
11 sanguinea, Cpr.

Liguus.
4 fasciatus, Mull.

Lima.
4 squamosa, Lam.

Limax.
4 maximus, Linn.

Limnæa.
2 auricularia, Drap.
12 caperata, Say.
20 catuscopium, Say.
3 columnella, Say.
22 desiduosa, Say.
15 elodes, Say.
16 humilis, Say.
15 palustris, Mull.
11 reflexa, Say.
15 stagnalis, Linn.
23 umbrosa, Say.
4 zebra, Tryon.

Lioplax.
8 sub-carinata, Say.

Lithasia.
6 florentiana, Lea.
19 plicata, Wetherby.

Lithocomis.
1 emaciatus, Reeve.

Lithodomus.
4 lithophaga, L.

Littorina.
15 angulifera, Lam.
6 asper, Phil.
20 irrorata, Say.
13 littorea, Menke.
3 obesa, Sowb.
4 palliata, Gould.
8 picta, Phil.
3 planaxis, Nutt.
18 rudis, Gould.
7 scutulata, Gould.
11 tenebrosa, Gould.
15 ventulata, Gould.

Lottia.
10 gigantea, Gray.

Lucidella.
1 aureola, Gray.
2 granosa, Gray.

Lucina.
4 canaria.
2 ebuonea, Reeve.

Lunatia.
4 heros, H. and A. Ad.

Machæra.
3 patula, Dixon.
Macoma.
9 inconspicua, Pr. and Sowb.
2 inquinata, Desh.
3 nasuta, Con.
2 sabulosa, Morch.
Macroceramus.
4 Gossei, Pfr.
3 lineatus, Brug.
Macrocyclis.
25 concava, Say.
1 Duranti, Newc.
2 Hemphilli, var. W. G. B.
6 Vancouverensis, Lea.
Macron.
3 lividus, A. Ad.
Mactra.
1 arctata, Con.
1 grandis.
2 solidissima, Chem.
2 truncata.
Malea.
1 latalabris, Valenc.
4 pomum, Lam.
Maleagrina.
7 margaritifera, L.
Malleus.
1 albus, Lam.
3 vulgaris, Lam.
Margarita.
9 cinerea, Couth,
4 helicina, Moll.
1 occidentalis.
Margaritana.
2 calceola, Lea.
5 complanata, Barnes.
1 confragosa.
10 dehiscens, Say.
12 deltoidea, Lea.
3 fabula, Lea.
2 Holstoniana, Lea.
5 margaritifera, Lea.
30 marginata, Say.
29 rugosa, Barnes.
4 undulata, Lea.
Marginella.
5 cœrulescens, Lam.
4 Jewettii.
14 labiata.
2 lineata, Lam.
8 longivaricosa, Lam.
6 margarita, Keiner.
9 monilis, Linn.
1 Storeri.
Marisa.
2 cornuarietis, Sowb.

Melampus.
3 ater, Mühl.
4 bidentatus, Say.
3 castaneus, Mühl.
24 lineatus, Say.
8 luteus, Quoy.
5 olivaceus, Cpr.
4 pusillus, Pfr.
3 striatus, Pse.
Melania.
4 altilis, Lea.
23 amarula, Lam.
3 annulifera, Con.
2 armigera, Say.
2 aspera, Lam.
1 Boykiniana, Lea.
6 bulla, Conrad.
1 coma, Con.
1 cylindracea, Con.
6 depygis, Say.
2 Duttoniana, Lea.
3 elongata, Lea.
2 fuliginosa, Say.
5 glabrata, Lea.
3 gracilis, Lea.
3 Haysiana, Say.
1 Hollandri.
4 integra, Say.
4 laqueata, Say.
1 lima, Con.
3 Newcombii, Lea.
7 nupera, Say.
23 obovata.
6 pernodosa, Lea.
1 pyrencleata, Con.
3 salebrosa, Conrad.
4 semicarinata, Say.
1 spixiana, Lea.
2 subularis, Con.
2 vestita, Conrad.
1 visata, Conrad.
50 Virginica, Say.
Melantho.
6 coarcata, Lea.
9 decisa, Say.
2 (Paludina) genicula, Con.
6 heterostrophia, Kirtland.
25 integra, Say.
16 ponderosa, Say.
9 subsolida, Anth.
Melo.
2 Diadema, Lam.
4 Indica, Gmel.
Menetus.
4 opercularis.
Mesodesma.
3 Chilensis, D'Orb.

Mesodon.
2 (Helix) Wetherbyi, Bland.
Microphysa.
4 vortex, Pfr.
Mitra.
3 adusta, Lam.
2 cadaverosa, Reeve,
2 casta, Swainson.
1 corrugata.
1 dactylus, Lam.
3 episcopalis, Lam.
2 fenestrata, Lam.
1 granitina, Lam.
8 granulosa, Lam,
2 Isabella, Swainson.
4 melongena, Lam.
5 pontificalis, Lam.
1 retusa.
1 scabriuscula, Lam.
2 versicolor, Martin.
2 zebra.
Modiola.
2 capax, Con.
3 plicatula, Lam.
5 tulipa, Linn.
Moera.
7 Gouldii, Hand.
Monoceras.
5 cingulatum, Kien.
6 crassilabrum, Lam.
Monoceros.
4 eugonatum, Con.
6 lapilloides, Mull.
1 lugubre, Sow.
Monodonta.
3 labio.
1 papillosus, Lam.
Mophalia.
4 Hindsii, Gray.
2 Magdalinsis, Hds.
2 muscosa, Bland.
Murex.
2 brandaris, Linn.
1 cornutus, Linn.
6 corrugatus, Sowb.
4 haustellum, Linn.
4 pinnatus, Wood.
6 radix, Gmel.
5 ramosus, Linn.
12 regius, Wood.
2 sexatilis, Linn.
5 tenuispina, Lam.
6 trigonulus, Lam.
Mya.
2 arenaria, Linn.
2 edulis.
1 truncata, Linn.
Mytilus.
3 Californianus, Con.
3 demissus.
13 edulis, Linn.
8 hammatus, Say.
1 perna, Soland.
1 smaragdinus, Chem.
Myurella.
4 simplex, Cpr.
Nacella.
5 palacea, Gould.
Nanina.
1 aulica, Sowb.
1 raregutlata, Mouss.
Nassa.
19 arcularia, Linn.
2 canaliculata, Lam.
3 Cooperi, Forbes.
1 coronata, Brug.
1 crenulata, Brug.
1 Cuvierii, Payer.
1 fossata, Gould.
2 gibbisula, Linn.
6 Jacksoniana, Kiener.
6 luteostoma, Kiener.
2 mutabilis, Linn.
1 neritea, L.
4 obscura, Kien.
8 papillosa, Linn.
2 pullus, Linn.
7 reticulata, L.
1 rufula, Kiener.
4 scalariformis, Val.
10 suturalis, Lam.
4 tegula, Rve.
15 vibex, Brug.
Natica.
3 conica, Lam.
8 caurena, L.
11 mamilla, L.
10 melanostoma, Gmel.
1 millepunctata, Lam.
9 stercus-muscarum.
Nautilus.
4 pompilius, L.
Navicella.
3 Freycincta, Richez.
Nerita.
3 versicolor, Gmel.
Neritina.
5 albicilla, Lam.
2 atrata, Lam.
2 chlorostoma, Brug.
5 corona, L.
5 latissima, Brod.
3 Mertoniana, Rd.
2 microptera.
8 morio.

Neritina.
8 peloronta.
7 picea, Wood.
5 picta, Sowb.
12 piseformis, Rechez.
3 polita.
14 reclivata, Say.
9 reticulata, Sowb.
8 Souleyetana, Rechez.
15 spinosa, Budgin.
2 Tahitensis, Less.
14 vespertina, Nutt.
6 Virginiea, Lam.
Neverita.
3 reclusiana, Petit.
Nucula.
2 margaritacea, Lam.
3 proxima, Say.
Nuttalliana.
3 scabra, Reeve.
Obba.
3 marginata, Mull.
Obeliscus.
4 dolebratus, Linn.
Ocinebra.
2 Poulsonii, Cpr.
Oliva.
3 angulata, Lam.
5 Braziliana, Lam.
3 candida.
12 carneola, Gmel.
18 Duclosiana, Jay.
4 episcopalis, Lam.
24 erythrostoma, Lam.
4 fulminaus, Lam.
5 irrisaus, Lam.
11 Ispidula, L.
1 jasperidæ, Lam.
24 leucophæa, Lam.
30 litterata, Lam.
5 maura, Lam.
8 Melchersi, Mke.
50 mutica, Say.
4 (Utriculina) nebulosa, Lam.
14 Peruviana, Lam.
3 ponderosa.
2 porphyrea, L.
22 reticularis, Lam.
4 sanguinolenta, Lam.
3 scripta, Lam.
2 splendidula, Sowb.
5 talpa.
2 tassellata, Lam.
5 textilina, Lam.
3 tremulina, Lam.
5 undata.
1 undata, var. bicincta, Lam.
5 undata, var. inflata, Lam.
Oliva.
2 venulata, Lam.
Olivella.
4 amazona, Lam.
18 biplicata, Sow.
4 daura, Mawe.
90 oryza, Lam.
20 sapatella.
6 semisarita, Gray.
3 undatella, Lam.
Omphalina.
5 exiguus, Stimp.
3 ferrea, Morse.
Ophiocardelus.
3 Brownii, Phil.
Orthalicus.
5 undatus, Brug.
Ostrea.
1 edulis, L.
4 lurida, Cpr.
2 Virginiana, Lister.
Ovula.
14 gibbosa, Lam.
4 oviformis, Lam.
2 verrucosa, Lam.
2 volva, Lam.
Pachydesma.
2 crassatelloides, Con.
Pachypoma.
1 cœlatus, Chem.
1 helicina, Gmel.
Paludina.
1 fasciata, Mull.
2 impura, Drap.
1 Maheyana, Grat.
2 naticoides, Fer.
3 unicolor, Lam.
2 viridis, Drap.
Parallelopipedon.
1 tortuosa, Linn.
Parapholas.
3 Californianus.
Partula.
2 abbreviata, Pse.
3 affinis, Pse.
2 bilineata, Pse.
2 crassilabrum, Pse
3 faba, Brug.
2 Garretti, Pse.
3 globosa, Pse.
3 gracilior, Pse.
3 Hebe, Pfr.
3 hyalina, Brod.
3 labiata, Pse.
2 lineolata, Pse.
3 nucleola, Pse.
3 Otaheitensis, Brug.
2 recta, Pse.

Partula.
5 rosea, Brod.
3 [illegible], Pse.
5 solidula, Reeve.
3 trilineata, Pse.
3 turricula, Pse.
6 varia, Brod.
Patella.
15 athletica.
8 testudinalis, Muller.
4 vulgata, L.
Patula.
40 alternata (varieties), Say.
3 asterisca, Morse.
2 Haydeni, Gall.
1 Idahoensis, Newb.
15 lineata, Say.
6 mordax, Shutl.
40 perspectiva, Say.
30 solitaria, Say.
20 striatella, Anth.
1 strigosa, Gould.
Pecten.
3 æquisulcata, Cpr.
5 concentricus.
5 viradians, Lam.
2 latiauritus, Con.
2 maximus.
1 nodosus, Lam.
12 opercularis, L.
2 pallium, Linn.
1 tennicostatus, Migh.
7 varius, L.
Petricola.
5 pholadiformis, Lam.
Phasianella.
7 australis, Gmel.
4 compta, Gould.
1 solida, Desh.
Pholadidea.
2 penita, Con.
Pholas.
2 candida, L.
2 costata, Linn.
3 dactylus, L.
Physa.
5 anatina, Lea.
6 ancillaria, Say.
3 costata, Newc.
8 crocata, Lea.
2 Curltoni, Tryon.
3 elliptica, Lea.
6 febigera, Lea.
12 Gabbii, Tryon.
27 gyrina, Say.
7 heterostrophia, Say.
11 Hildrethiana, Lea.
25 humerosa.
Physa.
5 Sayii, Tappan.
10 scalaria.
40 solida, Phil.
2 Wolfiana, Lea.
Pinna.
4 seminuda, L.
Pisidium.
2 abditum, Hald.
9 æquilaterale, Prime.
9 occidentalis.
8 compressum, Prime.
10 variabile, Prime.
8 ventricosum, Prime.
Placuna.
1 placenta, L.
Planaxis.
7 Sandwichensis, Con.
6 sulcata, Lam.
Planorbis.
14 bicarinatus, Say.
11 (Planorbella) campanulatus, Say.
2 complanatus, Pfr.
1 contortus, Drap.
2 corneus, Muhl.
1 corpulenta, Say.
4 deflecta.
5 Duryi, Weth.
5 (Menetus) exacutus, Say.
4 glabratus, Say.
2 hirsuta, Gould.
7 lentus, Say.
2 leucostoma, Mich.
2 marginatus.
3 minuta.
20 opercularis, Gould.
1 parvus.
1 tricarinata.
30 trivolvus, Say.
12 tumens, Carp.
Platyodon.
2 cancellatum, Con.
Pleurocera.
4 Dohertyana, Judge.
Pleurotoma.
3 australis, Lam.
1 Babylonica, Lam.
3 crispa, Lam.
2 diadema, Kein.
Polygyra.
2 (Helix) espiloca, Row.
3 (Helix) pustuloides, Bland.
Pomatias.
11 obscurus, Drap.
Pomatiopsis.
5 lapidaria, Say.
Pomus.
5 depressa, Say.

Proserpina.
7 nitida, Sowb.
Prunum.
6 diaphana, Kien.
Pseudachatina.
1 Krausii, Reeve.
Pterocera.
3 aurantia, Lam.
7 chiragra, Lam.
7 lambis, Lam.
1 millepeda, Lam.
1 scorpio, Lam.
Pterontus.
3 festivus, Hds.
Punctum.
10 minutissimum, Say.
Pupa.
40 armifera, Say.
4 (Isthmia) Bollesiana. Morse.
40 Californica, Rowell.
1 Cincinnatiensis, Judge.
10 (Leucochila) contracta, Say.
2 corticaria, Say.
2 dolium, Drap.
12 (Carychium) exignum, Say.
20 fallax, Say.
7 muscorum. Pfr.
5 (Isthmia) ovata, Say.
2 pagodotus, Drap.
5 pellucida. Pfr.
15 pentadon, Say.
3 Rowelli, Newc.
12 rupicola, Say.
2 uva, L.
Purpura.
2 anaxares, Duclos.
1 aptera, De Blainv.
30 astrina, var. fuscata.
2 bufo, Lam.
4 caniculata, Don.
1 carinifera.
5 cataracta, Lam.
4 chocolatum, Duclos.
12 colostoma.
2 columnellaris, Lam.
5 Conradi.
3 costata, Kiener.
3 crespata, Miod.
3 francolinus, Kiener.
8 hæmostoma, Lam.
3 harpa, Conr.
1 intermedia, Kiener.
20 lapillus, Lam.
3 macrostoma.
2 mandinella, Lam.
3 neritoides, Lam.
2 patula, Lam.
Purpura.
2 Persica, Lam.
2 planospira, Lam.
2 Rudolphii, Lam.
6 saxicola, var. fuscata, Forbes.
6 saxicola, var. ostrina, Gould.
5 squamosa, Lam.
1 succincta, Lam.
4 undata, Lam.
Pyrula.
6 perversa, Lam.
3 rapa, Lam.
3 spirata, Lam.
2 vespertilio, Lam.
Pythia.
3 argenoillier, Pfr.
2 striata, Reeve.
Ranella.
2 bufonia, Lam.
2 Californica, Hds.
1 cruentata, Sowb.
4 granifera, Lam.
2 granulata, Lam.
1 leucostoma, Lam.
1 spinosa, Lam.
2 ventricosa, Brod.
Rangia.
4 cyrenoides, Con.
Registoma.
3 complanata, Pse.
Ricinula.
9 albolabris, De Blain.
3 clathrata, Lam.
1 digitata, Lam.
4 horrida, Lam.
9 muricina, De Blain.
Rostellaria.
2 curvirostris, Lam.
Rotella.
14 lineolata, Lam.
4 rosea, Lam.
3 suturale, Linn.
Rowellia.
3 radiata, Cpr.
Sanguinolaria.
1 rugosa.
Scalaria.
3 communis, Lam.
2 pallasi, Kiener.
6 pretiosa, Lam.
Scaphander.
2 liguarius, L.
Scapharca.
4 transversa, Ad.
Schizostoma.
4 Alabamense, Lea.
3 incisum, Lea.
4 pumilum, Lea.

Scurria.
3 mitra, Esch.
Segmentina.
20 armigera, Say.
Semile.
2 decisa, Con.
Septifer.
5 bifurcatus, Reeve.
Siliqua.
4 costata, Say.
Siliquaria.
1 gibba, Speng.
Solarium.
12 granulatum, Lam.
3 perspectivum, Lam.
1 variegatum, Gmel.
Solecurtis.
2 Californianus, Con.
3 radiatus.
Solen.
2 ensis, L.
1 siliqua.
3 truncatus, Wood.
Somatogyrus.
2 isogonus, Say.
(Paludina) pallida, Lea.
3 sub-globosus, Say.
Sphærium.
2 fabilis, Prime.
9 occidentale, Say.
6 rhomboideus, Say.
3 simile, Say.
6 striatum, Say.
Spiroglyphis.
15 lituella, Morch.
Spisula.
9 solidissima, Gray.
Spondylus.
4 gæderopus, L.
5 princeps, Gmel.
Stenogyra, (see Bulimus).
5 octonoides, C. B. Adams.
Streptaxis.
1 contusa, Fer.
Strombus.
3 alatus, Gmel.
3 auris-Dianæ, Lam.
4 bituberculatus, Lam.
2 bubonius, Lam.
2 canarium, Linn.
4 floridus, Lam.
1 fusiformis, Sowb.
1 galæatus, Wood.
4 gallus, Linn.
14 gibberulus, Lam.
4 gigas, Linn.
1 labiosus, Wood.
2 lentiginosus, Linn.

Strombus.
3 luhuanus, Linn.
3 Peruvianus, Swain.
13 plicatus, Lam.
4 pugilis, Linn.
2 succinctus, Linn.
1 tricornis, Lam.
1 tridentatus, Gmel.
3 urceus, Linn.
1 variabilis, Swain.
6 vittatus, Linn.
Strophia.
2 glans, Kier.
5 striatella, Fer.
Struthiolaria.
2 nodulosa, Lam.
Stylodon.
2 unidentatus, Chem.
Succinea.
1 aurea, Lea.
5 avara, Say.
3 campestris, Say.
12 effusa, Shutl.
10 luteola.
4 Nuttalliana, Lea.
20 obliqua, Say.
4 Oregonensis.
6 ovalis, Gould.
5 Sillimani, Bland.
4 Totteniana, Lea.
Tapes.
3 litterata, Linn.
4 staminea, var. diversa, Con.
4 sulcaria, Lam.
2 tenerrima, Cpr.
3 turgida, Lam.
Tebenophorus.
10 carolinensis, Bosc.
Tellina.
1 lingua-felis, L.
6 radiata, Linn.
2 virgata, L.
Terebellum.
8 subulatum, Lam.
Terebra.
7 Babylonica, Lam.
10 coerulescens, Lam.
5 crenulata, Lam.
3 dimidiata, Lam.
2 duplicata, Lam.
2 Dussumierii, Kiener.
22 gemmulata, Kiener.
12 maculata, Lam.
3 muscaria, Lam.
6 occulata, Lam.
1 pertusa, Swainson.
1 robusta, Hinds.
1 (Acus) strigata, Sowb.

Terebra.
2 subulata, Lam.
Thalessa.
1 melones, Duclos.
Trachydermon.
2 ruber, Carpt.
Tridacna.
7 gigas, Lam.
2 squamosa, Chem.
Triquetra.
2 corrugata, Lea.
1 subviridis, Klein.
Tritia.
16 trivittata, H. and A. Ad.
Triton.
2 anus, Lam.
2 canaliferum, Lam.
5 chlorostomum, Lam.
2 clathratum, Lam.
2 corrugatum, Lam.
1 cutaceum, Lam.
6 distortum, Schub.
1 lampas, Lam.
2 nodiferum, Lam.
1 pirum, Lam.
13 rubecula, Lam.
6 sub-distortum, Lam.
1 succinctum, Lam.
1 tripus, Lam.
3 tuberosum, Lam.
2 variegatum, Lam.
Trochabella.
1 Tankervilii, Gray.
12 pulchella, Gray.
Trochita.
6 radians, L.
Trochotropis.
1 costellatus.
Trochus.
1 brevispina, Lam.
4 cinereus, var. electissimus.
3 conulus, L.
2 costulatus, Lam.
5 granulatus, Born.
1 Indicus, Gmel.
2 Niloticus, L.
1 pellis-serpentis, Wood.
3 Pharaonis, L.
1 spinulosus, Lam.
6 (Pomaulax) undosus, Wood.
6 virgatus, Gmel.
Trohiscus.
1 Norrisi, Sowb.
Trophon.
6 scalariformis, Gould.
Tropidaphon.
1 occlusus, Morch.
Truncatella.
4 cylindracea, Pse.
Tryonea.
40 protea.
Trypanostoma.
29 alveare, Con.
11 angulata, La.
6 annuliferum, Con.
20 canaliculatum.
8 elevatum, Say.
4 Formanii, Lea.
9 plicatum, Tryon.
21 prasinatum, Con.
6 pyrenellum, Con.
7 Toreniana, Lea.
22 undulatum, Say.
Tulitoma.
5 augulifera, Lea.
7 bimonilifera, Lea.
5 magnifica, Con.
Turbinella.
4 cornigera, Lam.
5 craticulata, Lam.
1 pugillaris, Lam.
3 pyrum, Lam.
2 rapa, Lam.
Turbo.
3 argyrostomus, L.
3 chrysostomus, L.
2 Cookianus, Chem.
5 funiculosus.
3 margaritaceus, L.
3 marmoreus, L.
3 muricatus, L.
1 Petholatus, L.
2 pica, L.
3 porphyrites, Gmel.
6 radiatus, L.
Turritella
12 cingulata, Sowb.
5 exoleta, Lam.
4 fuscata, Lam.
3 marmorata, Kiener.
7 radula, Kiener.
3 terebra, Lam.
2 torulosa, Kiener.
14 triplicata, Studer.
Unio.
11 æsopus, Gran.
14 alatus, Say.
2 amygdalum.
1 angustatus, Lea.
7 anodontoides, Lea.
2 aqilus, Lea.
4 arctatus, Lea.
1 argenteus, Lea.
1 asperatus, Lea.
4 asperrimus, Lea.

Unio.

? ater, Lea.
1 atrocostatus, Lea.
1 Batavus, Lam.
1 bialatus, Lea.
2 Bigbyensis, Lea.
6 Blandigianus.
1 Boykinianus, Lea.
5 brevideus, Lea.
9 Buckleyi, Lea.
3 capax, Green.
3 capsæformis, Lea.
5 cariosus, Lea.
64 circulus, Lea.
113 clavus, Lam.
106 coccineus, Lea.
3 cœlatus, Con.
2 coeruleus, Lea.
9 complanatus, Soland.
2 confertus, Lea.
2 congarius, Lea.
5 Conradicus, Lea.
4 Cooperianus, Lea.
1 corianus, Lea.
12 cornutus, Barnes.
46 crassidens, Barnes.
25 cylindricus, Say.
1 decisus, Lea.
5 declivus, Say.
117 donacæformis, Lea.
2 Dorfeuillianus, Lea.
4 dromas, Lea.
12 ebenus, Lea.
3 Edgarianus, Lea.
12 elegans, Lea.
36 ellipsus, Lea.
1 Estibrookianus, Lea.
8 fabalis, Lea.
7 Fisherianus, Lea.
3 flavidulus, Lea.
14 foliatus, Hildreth.
8 Formanianus, Lea.
5 fragosus, Con.
10 fuscatus, Lea.
106 gibbosus, Barnes.
6 glans, Lea.
6 gracilis, Barnes.
5 graniferus, Lea.
17 heterodon.
1 Hydianus, Lea.
1 inflatus, Lea.
53 Iris, Lea.
9 irroratus, Lea.
1 Jewitti.
2 Jonesi, Lea.
2 Kirtlandianus, Lea.
22 lacrymosus, Lea.
4 lævissimus, Lea.

Unio.

1 lens, Lea.
1 lenticularis, Lea.
2 lienosus, Conrad.
35 ligamentinus, Lam.
2 littoralis, Drap.
56 luteolus, Lam.
1 medellinus, Lea.
14 Metenevra, Rafinesque.
4 var. Wardii, Lea.
2 micans, Lea.
1 Mississippiensis, Con.
1 modioliformis, Lea.
6 monodontus, Say.
4 multiplicatus, Lea.
19 multiradiatus, Lea.
4 Nashvillianus, Lea.
9 nasutus, Lam.
2 negatus, Lea.
3 nexus, Say.
1 Nicklinianus, Lea.
2 nigerrimus, Lea.
1 Niloticus, Calli.
3 Novi-Eboraci, Lea.
6 nux, Lea.
1 obesus, Lea.
16 obliquus, Lam.
1 obscurus, Lea.
3 occidens, Lea.
4 ochraceus.
1 olivareus, Lea.
7 orbiculatus, Hildreth.
6 ovatus, Say.
112 parvus, Barnes.
1 perdix, Lea.
40 perplexus, Lea.
7 personatus, Say.
27 phaseolus, Hildreth.
1 Phillipsi, Con.
2 pictorum, Lam.
1 pictus, Lea.
46 plicatus, Lesueur.
2 pliciferus, Lea.
11 pressus, Lea.
1 pulcher, Lea.
1 purpureus, Say.
14 pustulatus, Lea.
8 pustulosus, Lea.
9 pyramidatus, Lea.
4 radiatus, Lam.
20 Rangianus, Lea.
37 rectus, Lam.
14 retusus, Lam.
6 ridibundus.
3 rosaceus, De Kay.
3 rotundatus, Lam.
4 rubellinus, Lea.
59 rubiginosus, Lea.

Unio.

5 Sayii, Tappan.
2 Schoolcraftensis, Lea.
8 securis, Lea.
1 Shepherdianus, Lea.
2 solidus, Lea.
5 Sowerbianus, Lea.
1 sparsus, Lea.
5 spatulatus, Lea.
5 sphæricus, Lea.
1 spinosus, Lea.
2 stabilis, Lea.
5 sublatus, Lea.
1 subovatus, Lea.
11 subrotundus, Lea.
4 subtentus, Say.
10 sulcatus, Lea.
1 Tampicoensis, Lea.
4 Tappanianus.
5 tenuissimus, Lea.
9 trapezoides, Lea.
46 triangularis, Barnes.
1 trigonus, Lea.
5 Troostensis, Lea.
15 tuberculatus, Barnes.
7 undulatus, Barnes.
3 Upsonii, Marsh.
6 varicosus, Lea.
26 ventricosus, Barnes.
3 venustus.
9 verrucosus, Barnes.
1 verus, Lea.

Urosalpinx.

3 cinerea, Stimps.

Valvata.

5 sincera, Say.
30 tricarinata, Say.

Venericardia.

2 borealis, Carp.

Venus.

1 flexuosa.
2 mercenaria, Linn.
1 paphia, L.
3 papilionacea, Lam.
4 Tiaro.
2 verrucosa, Linn.

Vermetus.

5 lumbricalis, Lam.

Vitrina.

1 latissima, Lewis.

Vitrina.

10 limpida, Gould.

Vivipera.

25 contectoides, Binney.
9 Georgiana, Lea.
7 intertexta, Say.
3 sub-purpurea, Say.

Voluta.

1 fulminata, Lam.
1 Junonia, Linn.
6 musica, Linn.
3 porcina, Lam.
1 scapha, Gmel.
3 vespertilio, Linn.
2 var. pellis-serpentis, Lam.

Yoldia.

7 limulata, Wood.
2 thraciformis, Stimp.

Zonites.

25 arboreus, Say.
5 acerra, Lewis.
4 Binneyanus, Morse.
4 capnodes, W. G. B.
3 capsellus, Gould.
3 cellarius, Mull.
2 conspectus, Bland.
3 demissus, Binney.
4 Elliottii, Redfield.
3 exiguus, Stimp.
2 ferreus. Morse.
4 friabilis, W. G. B.
5 fuliginosus, Griff.
15 fulvus, Drap.
12 gularis, Say.
4 indentatus, Say.
15 inornatus, Say.
1 intermedus, Fer.
13 internus, Say.
6 intertextus, Binney.
4 lævigatus, Pfr.
4 lasmodon, Phillips.
15 ligerus, Say.
17 limatulus, Ward.
3 milium, Morse.
6 minusculus, Binney.
10 multidentatus, Binney.
12 nitidus, Mull.
6 placentula, Shutl.
3 significans, Bland.
1 suppressus, Say.
9 viridulus, Menke.

ON THE TRACKS OF INSECTS RESEMBLING THE IMPRESSIONS OF PLANTS,

By M. R. Zeiller.* Translated from the French, by

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In his important memoir upon "Some Tracks of Invertebrate Animals," M. Nathorst mentions the tracks formed on the surface of clay soil by some animals, "that, immediately under the surface, give rise to cylindrical tubes or tunnels, parallel with the surface." He described principally, a track found by him on a clay road, "and with the same structure as that of Phymatoderma;" the unknown animal that had produced this, "having crawled under the surface of the mud, had forced into relief a great number of little rounded points," which produced a resemblance to those observed in this genus by Schimper, and compared by him to the papilliform excrescences of some *Caulerpa*.†

I have observed during the past summer near Villers-on-the-Sea, the tracks of this same genus, and have been struck with their resemblance to certain impressions of fossil plants. These tracks were found on the bottom of a little pool of water, which was sometimes nearly dry, aud was situated on one of the flat spaces formed on a steep part of the coast by the sliding of the marls of Oxford (marls of Villers). They were produced by an animal that had excavated galleries, .015 m. (6-10 of an inch) in diameter, and sunk to a depth of .005 m. (2-10 of an inch) below the surface, and parallel to it. The clay soil had been elevated into the form of a half cylindical ellipse, the upper surface of which was covered along its whole length with these rounded, blunt points. These sometimes assumed a very regular spiral arrangement, and at others were arranged in two parallel, longitudinal series, separated by a middle ridge. To give more clearly to these tracks the appearance of the impressions of plants, they branch quite frequently; one series of galleries starting out at right angles, sometimes to

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† A genus of sea-weeds. [J.]

the right, sometimes to the left, so that they seem to be part of a system. These branches run parallel with one another, sometimes approaching, but never branching further. The greater number are lost among the clusters of plants, horse-tails, and cat-tail flags, which crowd the pond; but others running between, begin clearly and end abruptly.

(M. Zeiller here refers to some figures of some of the fragments of these tracks) which I have preserved by taking away the soil, that, in drying, separated in small pieces, .010m (4-10 of an inch) thick, from the edges, and which, while yet soft and damp, easily left the layer beneath, to which they had scarcely adhered.

Their extent, their strong relief, and the regularity of the points with which these tracks are covered, suggests a comparison with *Phymatoderma*, especially with *P. liasicum;* at the same time it is difficult to forget the analogy which they present to certain impressions of Conifers of the genus *Brachyphyllum*, notably *B. Desnoyersi* (Brgt.), of the oolitic of Mamers and d'Etrochey.

I do not, however, in making this comparison, dream of questioning the vegetable nature of *Brachyphyllum*, though the case admits of a doubt. Nevertheless, I believe, that if we found in a fossil state, an impression bearing a resemblance to the tracks that I have just described, without a good idea of their nature, their resemblance to plants would cause us to place them, according to their greater or less clearness, either with the Coniferæ, closely allied to *Brachyphyllum*, or else with the Algæ, closely allied to *Phymatoderma*.

I have explored in vain, the galleries which cover the bottom of the pond, to discover the animal that has made these hollows; but while the search has so far been fruitless, I have succeeded, by examining the tracks which bear a close resemblance to them, in determining their author with certainty.

These tracks present certain characteristics. The floors of the galleries are composed of transverse ridges, all grouped by fours, to the depth of about .001m (1-40 of an inch); these ridges are like those that would be produced by a comb with four small teeth; are as large at the bottom as they are high, and are sharp pointed at the summit. On the ceilings of these galleries we observe a

regular series of impressions, corresponding to the toothed rim; while they also bear a resemblance to the marks made by the animal when forcing a passage through the soft clay, and so producing the rising on the bottom of the blunt points seen on the exterior. But as we find on the bottom the same tracks that are on the ceiling of the gallery, it is evident that the animal has turned on itself.

The appearance of the ridges on the ceiling of the gallery, as well as their size, remind one at once of the galleries of the mole-cricket. It should not, however, be inferred from this, that I believe these animals to live in the water. This has been brought to my mind very lately, by a letter from our member, M. Schlumberger, who, knowing the locality, remarks, that the ponds of the shelves of Villers are dry, at least, in part, during nearly all the summer, and that it would be urged against my facts, that the mole-crickets must have lived in places around these ponds, and extended their wanderings in search of food. I have, therefore, examined, as well as I could, the nature of the tracks of such animals as ought to live near these galleries. It is not possible to place under the necessary conditions, the living specimens of mole-crickets I have secured. I have, therefore, only experimented with the dead individuals, to see the tracks made by the jagged, comblike hind feet, as they press the earth. I have thus produced the toothlike impressions of the ceiling, left on the edge of the clay, and formed by these same feet, alternately to the right and to the left, just as they were made by the insects whence forcing a passage. I have given these details in full, and will add as a confirmation of them, that I have observed, in two or three parts of the ceilings of the galleries, the linear imprints, very delicate, fine, transverse striæ, identical with those produced by the antennæ of the same insects when resting lightly on the soft clay. It is thus positively to these mole-crickets (*Gryllotalpa vulgaris*), that we can attribute the tracks that I have observed.

I have, till the close, reserved my remarks on the analogy that these tracks present to the impressions of plants. If the ponds of Villers were to be covered by a deposit of sand, there can be no doubt that the more the sand penetrated into the galleries, the deeper the imprint of the mold would be made in the layer of grit;

and it would be accompanied in the marl beneath by a sort of branching stem in relief. This would show on the surface of the mold, the ridges, and the teeth of the edge of the gallery. These ornaments of this particular nature, should put us on our guard and make us cautious about attributing to a vegetable, a mold in a cavity made by the inner face of a layer of grit. But as the gallery may have been previously filled up by clay, and this is possible, it could not leave more than the one side in half relief, covered with blunt points, and we would then, without doubt, find it somewhat difficult to determine its true nature.

THE LITTLE SCREECH OWL (*Scops asio, Linn*).

By John W. Shorten.

Presented by Wm. Hubbell Fisher.

From the beginning of November, 1884, up to this date (February 3, 1885), I have personally examined the fresh bodies of not less than forty-five Little Screech Owls (*Scops asio L.*). All these I have skinned.

The plumage of fully two-thirds of this number was of the kind known as the Red, in contradistinction to that known as the Gray. This fact is interesting in view of the observations made to the east of the Allegheny Mountains, showing that there the Gray variety predominated.*

A remarkable fact in connection with these owls is, that they were, for the most part, taken in this city or its suburbs. Some of them came down through the chimneys into the houses and were captured. My theory is, that the owls sought the chimneys for protection from the weather.

I surmise that these birds were attracted to the city by the English Sparrows (*Passer domesticus L.*), which are found here in great numbers.

In my experience as a taxidermist and ornithologist, I have never met with so many Screech Owls in any winter, as I have between November, 1884, and February, 1885.

* For an interesting article on Dichromatism in the Screech Owl, in Ohio, Kentucky and Indiana, see this Journal, V., pp. 52, 53.

A FEATHERED POLICEMAN.

By J. Winchell Forbes.

Presented by Wm. Hubbell Fisher.

Geese once saved Rome, but the particular individual here concerned, appeared to find his office in repressing roam-ing propensities in his associates; and the palm for stupidity, so far as he was concerned, must be relegated to some other ornithological diversion, the *Dodo*, perhaps, or the Booby.

Billy, as we called him, could boast of no long line of anserestry, at least he never did, and his history previous to his advent in our neighborhood, in a peddler's wagon, is unknown. The blandishments exerted by a daddy dollar, were powerful enough to effect a change of ownership, and Billy entered upon a new life as a chattel of the writer. The only thing that we at first noticed as peculiar, was his great tameness; he, apparently, being greatly pleased at being picked up and stroked.

It being cold weather, he was placed in the chicken-house with the rest of the fowls, and at once made himself at home, meandering about with the evident desire of cultivating the acquaintance of his new associates, and showing at once a marked preference for certain individuals. In a few days, the weather becoming mild, all were turned loose into an adjoining lot, and then Billy's sagacity began to be manifest.

We had a young Cochin cock that was just beginning to crow; and Billy seemed to consider him as his especial charge. About an hour after their entrance into the vacant lot, my wife was alarmed by a hideous outcry at the back door. On looking out, there stood Billy, flapping his wings, and emitting those ejaculations peculiar to his species. Billy was in trouble, that was very evident, and he most unmistakably gave my wife to understand that she was wanted in the "lot," and led the way in the most vociferous manner. Two of the neighboring roosters had pitched upon ours, and Billy, seeing him unable to cope with such odds, had gone for help. Encouraged by the presence of my wife, he attacked the enemy again, and rescued his friend. Not satisfied

with this, he, with many a thump of his bill and a choice assortment of "cuss words," drove our own rooster back into the chicken-house, out of harm's way.

He appeared to recognize the middle of the lot as a boundary line, and would not allow any trespassing upon the side that he considered his property. Ever on the watch, he would drive off all strangers, and his hints to leave were not of the mild variety. The treatment of our fowls was very different, *herding* them as a dog does cattle, and keeping them within their own precincts when possible, and at night driving them into the hen-house. He appeared to know exactly how many there were, and was not content until he had hunted up and "corralled" the last one. The lot being unfenced, some occasionally strayed into the road, when Billy would become frantic, running to the house for assistance, if he found himself unable to manage them alone.

During the whole of his existence, gander Billy discovered many hidden hens' nests, and never failed to lead us to them, and what was most remarkable as evincing a *human* sagacity, he never objected to a *strange* hen depositing an egg, provided the nest was on our premises; but he would tolerate no *stolen* nests outside of the boundary.

Billy died; perhaps it is more true to say, he was *caused* to die, as the very points that made him peculiar, rendered him also a nuisance, for the air was thick with clamor all day long. The final "straw," however, was the fact that he had taken unto himself a wife in the shape of our best hen, and Billy's speedy removal became necessary, as a matter of hen-preservation. This short history is far from being complete, but it is enough to show that some human individuals would require an increase in brain weight to admit of their being styled "*Geese.*"

REPORT AND OBSERVATIONS ON RELIC FINDS.

By Walter A. Dun, M. D.

It is my purpose to-night to call your attention to the importance of accuracy in observing the surroundings of all relics which are found in all diggings. This is of such importance, that I know you will all permit me the opportunity of consuming a few minutes in its consideration. I am satisfied, in my own mind, that man existed on this continent before our last drift period, reaching back in time, as we are told by astronomers, at least forty thousand years. To my own knowledge, there have been many relics of man taken from wells dug into the drift at a depth of twenty feet and more. Such relics are looked upon as curiosities, pondered over awhile, and finally put on the parlor mantel to be kept, and only seen when a stranger appears. If, by chance, a scientist happens along, and the story is told and the relics produced, there is always sure to be some vagueness of memory or description which allows room for doubt. The seeker after facts asks, How do you know that a previous hole hadn't been dug from the surface by modern inhabitants, such as our Indians or their ancestors? How do you know but that the diggers of the well purposely placed these relics where they were found, in order to excite your curiosity? Human nature is so fond of that which is marvelous, that few can resist the temptation of exciting comment, and, consequently, such questions as the above are very pertinent ones. It is important, in order to fully verify these finds, that you should investigate them at once. As a fact, few of them come to light, except long after they occur; and time here, as elsewhere, casts a shroud of mist about them which obscures their importance and questions their authenticity. All this is eminently proper, because we are looking for the real truth; absolute truth we must have, and substantiate it only by absolute proof, in order to have a basis from which we can appeal to the astronomer for data concerning age, thus settling, in some degree, the antiquity of man. But the importance of observation in such cases does not end here. Specimens should be carefully separated, labeled, and accounts of them reported to some scientific body or journal. To illustrate: Often

we find the following label on a specimen—"From a mound." Now we know that mounds were used as places for burial by inhabitants who came after their builders. We also know that there are those who claim that the Indians, as we knew them, descended from the Mound-builders. How are we to decide upon the truth of such a claim? First, collect facts about both, putting in each series that which belongs there, and laying aside all doubtful ones. Since both races of people used the mounds for burial purposes, anything labeled, "From a mound," means nothing but uncertainty. If, however, proper care is taken in excavating a mound, there are always things which can be classed, "Undoubtedly Mound-builder." After a long time, the collection of such facts will form a basis upon which conclusions can be made and a definite answer given to this indefinite and perplexing question. In this brief introduction, I have tried to point out to you the interest and importance surroundlng some relics; and, although archæology may not be in the line of your special interest and study, still it is of so much importance, that I hope you will never neglect any opportunity of carefully investigating, noting, observing and reporting all finds to which an interest is attached. If this paper succeeds in impressing you with the importance of such an object, it will have accomplished the purpose for which it was written.

To begin with the good work in this connection, I desire to call your attention to a flint arrow-head. It is rather a perfect specimen, of good workmanship, and with beautiful notched barbs. Beyond that, it offers nothing of interest, and is certainly nothing beyond any relic found on the surface, unless it can offer something in its history, which is as follows:—

It was found at Plunwood, my father's farm, in Madison County, Ohio, during one of my visits home, and I immediately investigated the find thoroughly, and can vouch for its history. Madison County is situated near the central part of the State, west of the Scioto River, into which the streams flow which drain the entire county. It is so flat in every part that it is almost as level as a prairie. Here and there the surface rises in low knolls, or dips down into shallow depressions, but seldom varying more than five or ten feet in a mile. Along the streams, which are very sluggish,

the banks rise to the height of thirty or forty feet in some places, forming the only exception to the general character already described. The ground is all of the drift formation, covering great subterranean water-beds, which give rise to many springs, and when tapped by wells furnish an inexhaustible supply of water. All of this is underlaid by the Helderberg limestone, which appears in a limited space in the bed of one small stream and furnishes the only outcrop of stone in the county. When the country was first opened up for settlers, this county became, in springtime, very swampy. All the shallow depressions filled up with water, and the land was considered too flat and low for farming purposes. After the summer these pools dried up, and during the fall the Indians from the higher lands in Champaign and Logan Counties were accustomed to start fires ahead and follow down through this region in their annual journey to the Hocking Valley for salt. These annual hunts in the wake of forest fires, while aiding the Indian, left a barren region behind, and most of the timbers of the forest became stunted and knotty in consequence. This fact gave the name of "The Barrens" to a region which is now one of the most fertile and productive in the whole Scioto Valley. So much has been said in order to point out the fact that there were no regular Indian inhabitants, no villages or populous communities of prehistoric people; and as they were accustomed to use it little, there are almost no relics found on the surface. I know of no region where stone relics are so scarce, and where those found, as a rule, show poorer workmanship. In some of the knolls are gravel, which is sought for in building macadamized roads, and in the gravel banks occasionally are found a few skeletons and a few relics, buried at the depth of a few inches. Nowhere in the State has tile-draining done more good than in Madison County. Year by year the shallow pools have been drained, until now only a few are left. In putting in the tile-drain in such a depression on the farm, the ditchers came on the arrow-head which I show you. The depression in question is almost circular, and is about a quarter of a mile in diameter. My earliest recollection of it was a place filled with water in the spring, and in the summer filled with cat-

tails and sedges or wild grass, and a common resort for rattlesnakes, and consequently to be avoided by children.

One very dry autumn, shortly after the war, it was set on fire, and continued to burn and smolder for a couple of weeks, leaving on top light ashes. This may give you some idea of the carbonaceous character of its bed, which was closely allied to peat. The peaty character extends down to an undetermined depth at the center of the depression, but at the margin tapered to a feather edge, and near the margin of the dish, as I knew it, was four feet and a half thick. Under the black peat lay white marl, extending down a considerable depth. At the bottom of the peat, and lying on the white marl, at the depth of four feet and a half, near the edge of the depression, the arrow-point was found. I believe the explanation of it is simple. In the past, a small lake, with many shells, existed, and formed the marl which made up the white layer at the bottom. In this lake was game, at which some aboriginal inhabitant fired the arrow, and it sank to the bottom of the lake. Time passed, vegetation sprang up, and finally formed the peaty layer four and a half feet thick.

I will not draw any conclusions as to the time thus occupied, neither will I speculate upon its probable age. That will be left to the botanist and geologist. All that is to be said in conclusion is, that the peaty layer spoken of is composed in small part of washings from the low, clayey knolls immediately surrounding the depression, and from which the washings must have been very slow. It is my purpose to report to this Society a number of relic finds, about which some points of interest center, and any one who can and will contribute others, will be conferring a favor.

Mr. L. S. Cotton announced the death of Mr. R. B. Moore, a former President and a Trustee of the Society. On motion, a Committee, consisting of Mr. L. S. Cotton, Dr. R. M. Byrnes and Dr. A. E. Heighway, was appointed to prepare a memorial notice for publication in the JOURNAL.

Mr. Chas. Dury exhibited a specimen of the "Whip-Scorpion," or "Mule-Killer" (*Threyphorus giganteus*) from Florida. He said

that the natives considered a sting from this creature to be certain and speedy death; but it appears from a recent monograph of the scorpions that this one is the only species destitute of a sting.

Mr. Edward M. Cooper read an extract from "An Account of the Discovery of a Mastodon's Remains in Northborough, Mass." It was found about seven or eight feet below the surface. Nine teeth, numerous pieces of bone belonging to the head, and portions of the tusks were secured.

The following names were proposed for membership:

W. H. Knight,	Chas. L. Faber,
Rev. I. F. Stidham,	Chas. Schuchert,

E. H. Vaupel.

The name of Mrs. John B. Gibson was presented for honorary membership. It was referred to the Executive Board for action.

The following were elected to regular membership:

Rev. Raphael Benjamin,	Sam'l R. Singer,

Geo. B. Twitchell.

The resignation of Florian Giauque was read by the Secretary, and referred to the Treasurer for action.

The following letter was read by the Secretary:

CINCINNATI, OHIO, Dec. 5, 1884.

DAVIS L. JAMES, ESQ.,
Secretary Cincinnati Society of Natural History.

Dear Sir:—The Cincinnati Amateur Photographic Club tender a vote of thanks to your Society for their kind compliance with our request to meet once monthly, for the coming six months, in your Society-rooms, 108 Broadway. The Club also extend a cordial invitation to the members of the Cincinnati Society of Natural History to join them in their meetings and discussions.

Very truly yours, JOHN B. CLUNET,
Secretary Cincinnati Amateur Photographic Club.

The death of Henry Pearce, and of Andrew Erkenbrecher, two members of the Society, was announced by the Secretary.

The donations for the month, were as follows: from T. H. Wise, "The Young Mineralogist, Vol. I., Nos. 4, 5, 6, 7;" from Mrs. S. Burlingame Rankin, "Marianne, and Other Poems;" from H. M.

Cannon, "Annual Report of the Comptroller of the Currency for 1884;" from J. E. Bruce, Vol. V., "Geological Survey of Ohio;" from C. E. Beecher, "Some Abnormal and Pathologic Forms of Fresh-water Shells from Albany;" from Chief Signal Officer, "*Monthly Weather Review*, Nov., 1884;" from Bureau of Education, "Building for the Children of the South," and "Circular of Information, No. 6, 1884;" from Edward M. Cooper, Specimen of Fossil-wood; from Publishers of Publisher's Weekly, "Library Aids;" from Commissioner of Agriculture, "Agricultural Grasses of the United States;" from N. H. Winchell, First and Twelfth "Annual Reports of Geological and Natural History Survey of Minnesota;" from Smithsonian Institute, "Coues and Prentiss Avifauna Columbiana;" from Chas. Dury, thirty-six species of Lepidoptera, one species Neuroptera; from Dr. W. A. Dun, specimen of Arrow-head.

On the evening of February 6th, Gov. J. D. Cox delivered a lecture upon "Diatoms." He opened by noticing the character and position of Diatoms in the scale of life. They are among the lowest forms of vegetables, and are present in all sorts of places. Their silicious skeletons make up thick strata of rock. They multiply by fission. A full explanation of the structure of the wall of the Diatom was given; the investigations of the lecturer showing that the walls of the Diatoms are pitted, and that an intercellular space exists between the two walls. The remarks were illustrated by a number of magic lantern pictures of broken Diatom shells, which showed the structure accurately.

On February 13th, S. S. Bassler lectured on "Weather Changes: How Caused; How Foreseen." After describing the causes of the change of the seasons, and the winds of the equatorial and temperate regions, the lecturer gave a brief history of weather predictions in the United States. The first work of this kind was in 1869, by Professor Cleveland Abbe, in this city, who, by the aid of the Chamber of Commerce and the Western Union Telegraph Company, prepared predictions of the weather. The Signal Service, at Washington, was organized in 1870, with Professor Abbe at its head. The laws governing the development and progress of storms, were touched upon in a concise manner, and at the close,

some of the audience manifested their interest by gathering round the speaker and asking questions on various topics connected with the weather.

On February 20th, Mr. W. H. Knight lectured on "Meteorites, Shooting Stars, and Comets." "The Rosetta Stone of the Universe is the spectroscope. With its aid we can read the message brought to us by light, proclaiming that the universe is constructed upon the same basis and of the same materials as our own earth." Shooting stars, meteors and meteorites were described at length. The most wonderful of the meteors was that of 1860, which passed over the earth from Green Bay to Long Island. It was estimated to be one thousand feet in diameter, and at its nearest approach to the earth, to be only thirty-nine miles high. The lecturer stated that in no case had he been able to verify accounts of loss of life by the fall of meteorites, although such cases are often reported, and narrow escapes are common. There are four large collections of meteorites in the United States. The largest, that of J. Lawrence Smith, of Louisville, containing nearly five hundred specimens, was sold, a few years before his death, to Harvard University. Sometimes as many as three thousand stones fall in a single shower. Meteorites invariably contain iron, often in combination with nickel. Some are so pure as to be malleable when picked up, and horseshoes have been forged from pieces of them. No new metals have been discovered in these bodies, and twenty-two of the chemical elements have been detected. The largest meteorite mentioned, is in Mexico, and weighs about five thousand pounds. The nearest visit of a meteorite to our city, was in 1877, when one fell at Cynthiana, Kentucky.

On February 27th, Dr. Walter A. Dun lectured on "The Scientific Value of Arctic Explorations." The lecturer, after a general statement of the phenomena of heat and life, more especially in relation to the Arctic regions, entered on the general subject of the value of the results of the various expeditions sent to the North. He did not find their value to either science or traffic to be at all commensurate with the expenditure of life and treasure. Half the amount expended in investigating the resources of southern countries, Mexico, for example, would yield a much larger return. The

motives of Arctic explorations have been those of adventure, as the Norsemen, who were the first investigators of these regions; those for the discovery of the Northwest Passage, the search for the Pole and for Sir John Franklin. The latest is that of the meteorologists, who desire to obtain synchronous observations of the weather from all parts of the world.

The value of the country embraced within the circle of 60° north latitude, is almost nothing. The economic products of the region are confined to furs, a little ivory from Siberia, fish and whale oil. The sketch of the physical character of the country, and its fauna and flora, was illustrated with lantern views and specimens. Man, living under circumstances which surround him in the frozen North, is probably the most interesting subject of investigation. He is a carnivorous animal, for, in the absence of plant life, animals alone supply his wants.

MEETING OF MARCH 3, 1885.

VICE-PRESIDENT SKINNER in the Chair; twenty persons present. The following were read, and referred to the Publishing Committee:

NOTES ON FOOD OF RAPTORIAL BIRDS.

By CHAS. DURY.

THE hawks and owls are popularly regarded as very injurious birds, and always killed when opportunity presents itself. Some of the States offer rewards for scalps of raptorial birds, without any distinction of species. The Legislature of Ohio authorized the commissioners of each county to pay a bounty of 50c. each, for hawk scalps, and hundreds of dollars were expended in this way. Recently, however, I believe, this law was repealed. Several American ornithologists have made observations on the food of our birds, but none so thoroughly as Prof. Forbes, of Illinois, who has dissected hundreds each of several of the most common species, and at all seasons of the year. The result of these observations he has tabulated. This is the only correct way of arriving at the economic value of species of birds.

The food of many species varies much with the season, and it is

rather astonishing that our resident species are enabled to find subsistence during very severe winter weather. I was much interested during the winter of 1883 and 1884, in the visits of some of our familiar species to the very fat body of an Emu, which I had skinned and securely fastened in the limbs of tree near a window in my workshop. This body remained from November to April, and was visited by the following species: crow, blue jay, golden-winged woodpecker, downy woodpecker, blue-bird, white-bellied nut-hatch, tufted titmouse, Carolina titmouse, great Carolina wren, brown tree-creeper, and golden-crested kinglet. All of these fed on it. The jays and Carolina titmice were the most frequent visitors; they would eat their fill about every two or three hours. I have seen several species feeding on it at the same time. The European sparrow and cardinal grosbeak, though they frequented the tree, were not observed to eat any of it. I scored the fat with a knife so they could pull it off easily when frozen. The carcass presented a curious sight when I took it down, being nearly worn out. This year I hung up the body of a fat Grebe, but this did not seem to be as much liked as the Emu, as only a single crow and several jays and titmice have been observed to dine on it. However, birds are not nearly as abundant this season as last, in Avondale. I give in a brief manner the result of the dissection of the bodies of the following species, from my note-book of 1884 and 1885:

Red-Shouldered Hawk (*Buteo lineatus*).

Dec. 4, 1884. Male. Filled with grasshoppers. Bird killed near Winton Place.

Nov. 13, 1884. Male. The stomach was filled to distention with grasshoppers (*Caloptenus femer rubrum*).

Dec. 2. Male. Filled with grasshoppers and mice. Several others examined during winter, contained mice.

The remarkable fact here is, that this species feeds on grasshoppers, and can find them as late as Dec. 4th.

Bald Eagle (*Haliaetus leucocephalus*).

Nov. 10. Young female contained fish.

Jan'y 15. Young (very large) female contained balls of rat-hair.

ROUGH-LEGGED HAWK (*Archibuteo lagopus*).

Jan'y 15. Female. Stomach filled with parts of four large field mice.

Jan'y 27. Male. Filled with mice.

This is rather a rare bird in this locality.

GREAT HORNED OWL (*Bubo Virginianus*).

Several examined were empty, but the stomach of one male on May 13th, contained a few feathers, a small bunch of hair, and a beetle (*Lachnosterna fusca*).

Nov. 20. Female. Contained a quail.

Nov. 24. Male. Contained part of chicken.

BARRED OWL (*Syrnium nebulosum*).

Nov. 11. This bird contained a partly digested screech owl (*Scops Asio*), feathers, body and feet.

Nov. 30. Male. Contained mice.

Jan'y 16. Female. Contained mice.

Jan'y 16. Male. Stomach contained part of red-bellied woodpecker, including head and bill.

The idea of one owl swallowing another, is a new phase of owl etiquette to me.

SHORT-EARED OWL (*Brachyotis palustris*).

Nov. 9. A male was filled with mice—several others contained mice.

Nov. 11. A female contained two European sparrows, for which service she deserved a better fate than to be shot.

COOPER'S HAWK (*Accipiter Cooperii*).

May 11. Stomach contained young bird.

May 24. Male. Stomach contained partly digested hermit thrush.

Feb. 7. Stomach contained one European sparrow.

BARN OWL (*Strix flammæ*).

Since my paper published in the JOURNAL, Dec., 1883, several others have been taken in this vicinity; in all of them were mice and their remains.

SHARP-SHINNED HAWK (*Accipiter fuscus*).

Jan'y 18. A sharp-shinned hawk, a male, pursued a European sparrow into a store on Third Street, this city, and captured the sparrow inside the store. The door was closed and the hawk secured alive.

SCREECH-OWL (*Scops Asio*).

This species has been unusually abundant; very many have been examined. I enumerate a few of these.

April 10. Male. Filled with insects, mostly beetles.

May 22. Female. Contained beetles.

Oct. 10. Eight owls, in all of which were insects, mostly beetles.

Nov. 8. One owl contained millipedes.

Nov. 24. One owl, male, contained insects.

Dec. 5. One owl contained mice.

Dec. 11. One owl contained mice.

Jan'y 13. One owl contained thirteen large larvæ, commonly called cutworms (larvæ of *Agrotis*), and several *millipèdes*.

Jan'y 25. One owl contained mice and one European sparrow.

These little owls are very beneficial birds. They seem to feed on insects, in preference to anything else, if they can get them. I have been puzzled to tell, where the owl of January 13th obtained the cutworm larvæ. The bird seemed to be a resident, as its feathers were soiled with black coal soot, commonly seen on the birds that linger long in the vicinity of the city. The raptorial birds are almost always very fat, proving they take good care of themselves.

Note.—Since the reading of this paper, the letter appended has been received. It explains itself:

CIRCLEVILLE, March 5, 1885.

MR. CHARLES DURY:

Dear Sir—I noticed a report in yesterday's *Daily Enquirer*, of a paper read by you before your Society of Natural History, on Rapacious Birds.

Allow me to add some testimony to our much needed knowledge of birds of this class.

For many years I have personally known the value of our large

horned owl, as a "ratter," and will cite one instance in particular as proof.

About eight years ago, one of my men discovered a pair of owlets of the large-horned variety, in an old sycamore stub, near my stables on my farm, and concluded to capture them alive. With some risk to himself, he succeeded in securing them, but not without a regular fight with the old ones, who gave him a few wounds. In the nest where he got the young owls, he noticed several full-grown Norway rats, with their skulls opened, and the brains removed. On descending to the ground, he also noticed the bodies of many rats around the tree, and out of curiosity counted them, and found the bodies of 113 rats, most of them full-grown. They all appeared to simply have had their skulls opened, and the brains removed; and from their undecayed appearance, must all have been captured within the previous week, or ten days.

These young owls were taken to C. R. Goldrudeick, Circleville, reared to full growth, and kept several years. They were fed liberally with scraps of fresh beef and the offal of fowls, and having more feed than they could consume, their domicile became an attraction to rats, which are very numerous about the premises. The owls soon got on to their business, and commenced killing the rats. It was a frequent evening remark made by the proprietor of the grocery where they were kept, "They have got another one." "Got another what?" "Why those owls have just got another rat; I heard them." While apparently asleep, and playing "possum" on their perch, if an unlucky rat crept into their cage, they would pounce down and kill it as quickly as any rat-terrier, and take the brains out only.

On account of their nocturnal habits, from my personal experience and observation, I consider the owl, especially the great-horned owl, a bird of great value to the farmer, especially as a ratter. Yours, O. E. Niles.

At the conclusion of the reading of the paper, Mr. Wm. H. Fisher stated, that at Cumminsville, where a number of large trees had been cut down, quite a number of owls had been found. He corroborated Mr. Dury's statement, that one owl will feed on

another, by an account of a circumstance which had come under his own observation. A screech-owl had escaped from a part of a large cage into another part of the same, where there was a large-horned owl. In the morning, only the remains of some feathers of the screech-owl were to be found in the cage. He described the manner in which an owl swallowed a mouse. The prey was caught in the middle of the body between the mandibles, and immediately jerked round with the head toward the throat, and with a sudden gulp disappeared.

Mr. Dury remarked, that at the Zoölogical Gardens, screech-owls fought with and killed one another. He further stated, that in Clermont County he had dissected a specimen of polecat, whose stomach was filled with grasshoppers. This animal bears the reputation of being a depredator on chickens, and is universally condemned by farmers.

Mr. Wm. Hubbell Fisher read a note from Rev. John G. Black, of Bellaire, Ohio, relative to the finding of wood-thrush in the vicinity of his residence, during the present winter.*

Mr. Dury remarked, that the wood-thrush is so entirely an insectivorous bird, that it did not seem possible that it was a winter resident in Ohio. He considered there must have been a mistake in the identification. He stated, that even in Florida, when the birds arrived, they came from the South, showing that they wintered even farther to the south than Jacksonville.

IN MEMORIAM.

(R. B. Moore.)

The undersigned committee, appointed to prepare a memorial of the life of R. B. Moore, beg leave to report the following:

Richard B. Moore was born near Bethel, Clermont County, O., December 28, 1815, and died at his home in Wyoming, Hamilton County, O., January 25, 1885.

The place of his birth was, at that time, a wilderness; his parents, like many of the pioneers, were in straightened circumstances, and

*Since this Mr. Fisher has received the bird referred to by his correspondent, and finds it to be the Towhee Finch, instead of the Wood Thrush.

the advantages and luxuries of the present day were unknown to him in his early life. At the age of 13, his father's home, with its contents, was destroyed by fire, and he then came with his father to Cincinnati, and by driving a cart, assisted in digging the Miami Canal. In 1832 he learned the trade of brickmaking, and afterward became a contracting bricklayer, his last building being the old post-office, southwest corner of Fourth and Vine; after which, for forty years, he was measurer of stonework, brickwork and plastering. In 1836 he joined the I. O. O. F.; October 24, 1840, he was married to Rebecca Jane Hemphill, who survives him; 1851 to 1858, he represented the old Sixth Ward in the City Council, and afterward represented the old Eighth Ward for many years.

During the war he was an active member of the Sanitary Commission, and made several trips in charge of boats, distributing sanitary supplies. From 1858 to 1879, he was President of the Cincinnati Relief Union. He was one of the first members of the Cincinnati Society of Natural History; was President of the Society in 1878, and was one of the three Trustees of the Society, uninterruptedly, for many years, to the time of his death.

He early developed a remarkable taste for study, and frequently, before he was 13 years of age, walked barefooted, to Richmond and back, a distance of over 10 miles, to borrow a book. During the last 25 years, he devoted much time and study to geology, and the collection of fossils and specimens of natural history, of which he leaves a large cabinet, and also a valuable library of scientific works. During the last five years he gave special attention to the study of astronomical measurements and calculations, which he connected with the measurements of the pyramids of Gizah.

His early privations imbued his whole life with sympathy for the poor and unfortunate; his early necessities inured him to hard labor, and taught him the sure road to success; his business brought him constantly in contact with the laboring classes and the poor, and with their sufferings and misfortunes; united to these, his unbounded enthusiasm and untiring energy made him a most efficient promoter of the interests of the laboring class, and a protector and supporter of the poor and unfortunate. These qualities have received public recognition in his prolonged service in the various

offices he was called upon to fill, and especially in his 21 years' service as President of the Relief Union, during which time thousands were benefited by his labor.

Very respectfully,

L. S. COTTON,
R. M. BYRNES,
A. E. HEIGHWAY. } Committee.

A CONTINUATION of the Mycologic Flora of the Miami Valley, by A. P. Morgan.—*Polyporei*—was read by title. This paper will appear in the next number of this JOURNAL.

Prof. Jos. F. James called the attention of the members to a set of of Arizona Plants, lately purchased from C. G. Pringle. Also to a donation of fifty-two species of fossils from C. L. Faber. He referred to photographs of Mr. W. H. Edwards and Mr. Isaac Lea, presented by Mr. Chas. Dury, stating, that on March 4th, Mr. Lea would be 93 years old, having been born in 1792. Mr. Lea is celebrated as a writer on conchology, having described over 700 species of Unionidæ, besides many species of Melania and of fossils.

Dr. O. D. Norton made some remarks on the mastodon found at Newburg, N. Y., and now in the Warren Museum, in Boston. The tusk from the lower jaw, found at the time, became separated, and was for a long time kept apart from the skull, but is now in its proper place. One peculiarity about this mastodon was, that two of the ribs, having been once broken, were united during the life of the animal.

In the discussion which followed, many members took part. Dr. W. A. Dun referred to the finding of mastodon remains near Hopeton, Ohio, in a bed of peat. Mr. Cotton referred to the finding of remains in various parts of the city and suburbs, in the alluvium. He stated, that when a well was dug opposite where the Burnet House now stands, there were taken from a depth of fifty-five feet, leaves, twigs, etc., of trees. From the material taken

from this depth there sprang, when spread on the ground, great numbers of mulberry trees. It is supposed the seeds were in the soil in a dormant state, and developed when brought under suitable conditions.

Dr. Norton stated that he had seen remains taken from various localities in this city, showing the former presence of the mastodon in this vicinity. He said that many of the European and Eastern Museums had been supplied with specimens from here, and he was glad that a few could now be retained in the Museum of the Society. Mr. Edw. M. Cooper read an extract from the last report of the State Geologist of Indiana (1884), relative to the Mastodon in the Mississippi Valley.

The following were elected to regular membership:

Wm. H. Knight, Rev. I. F. Stidham, Chas. L. Faber.

On the recommendation of the Executive Board, Mrs. John B. Gibson was elected an honorary member of the Society.

Mr. L. S. Cotton was appointed a committe of one to procure, if possible, a portrait of Mr. Robt. Buchanan, a former life member, and a liberal donator to the Library and Museum.

Mr. Dury spoke of the desirability of procuring portraits of eminent scientific men, for the adornment of the rooms. The matter was referred to the Executive Board for action.

The following were the donations announced for the month:

From Census Bureau, Vol. IX. of Tenth Census, with atlas; from Department of the Interior, Vol. III. U. S. Geol. Sur. of Territories under Hayden; from Hon. John. F. Follett, Report of National Academy of Sciences for 1883, and Vol. II., Memoirs of National Academy of Sciences; from Director of Geol. and Nat. Hist. Sur. of Canada, "Comparative Vocabularies of Indian Tribes of British Columbia," and "Sketch of Physical Geography and Geology of Canada," with map; from Chief Signal Officer, "Monthly Weather Review," Dec., 1884; from Public Museum of Milwaukee, "Second Annual Report," and "Circulars Nos. 1 and 2 of Trustees"; from Dr. Heath, Specimens of Crude Paraffine, and Quartz and Mica; from Wm. Holden, "Palæontology of Ohio," Vol. II.; "Smithsonian Institution Reports for 1879 and

1880; "American Naturalist," Vol. I., Reports on Rocky Mt. Locust," for 1877 and 1878–79, "Hagen Monograph of N. Am. Astacidæ," "Monograph of Diptera of N. Am.," "Catalogue of Diptera of N. Am.," "Proceedings of Am. Phil. Soc., Vols. XV. and XVI." "Catalogue of Coleoptera of N. Am.," "Packard on Geometrid Moths," "Record of American Entomology," "Naturalist's Directory, 1878," "Leconte Coleoptera of N. Am.," Part I. and six pamphlets; from Lieut. Thos. L. Casey, Part II. of "Contributions to the Descriptive and Systematic Coleopterology of N. Am.;" from Am. Soc. of Microscopists, Proceedings of Seventh Annual Meeting; from Prof. John Collett, 14th Report of State Geologist, 1884; from Smithsonian Institution, Nos. 31, 32, 33 of "Proc. U. S. Nat. Mus., Vol. VII.;" from Wm. Hubbell Fisher, Eight species of plants for Herbarium; from Chas. L. Faber, Fifty-two species of fossils from Europe, Ohio, Indiana, and Kentucky, specimen *Favistella stellata*, and 4 specimens of Indian Relics; from Dr. W. A. Dun, 2 Circum-Polar Maps; from U. P. James, section of wood of *Cornus Florida*.

GLYPTOCRINUS BÆRI, MEEK.

A SLAB of limestone about 12x15 inches, having on its surface fifty specimens of the above named and heretofore considered rare species, is now on exhibition at the rooms of this Society. Many of the specimens are nearly perfect, showing body, arms, fingers, and fimbriæ. In some cases several inches of the stem remain attached to the base. All of the specimens are in bold relief, having been developed with great care by Dr. D. T. Dyche, of Lebanon, Ohio.

This slab is, no doubt, the best group of specimens of this species yet discovered. It was found by Dr. Dyche, in the upper part of the Cincinnati Group, in Warren County, Ohio.

U. P. JAMES.

On March 6th the last of the course of free popular lectures was given by Mr. Charles Dury. It was entitled "An Hour with Birds." He began by defining a bird as a vertebrated animal, with warm blood and feathers, which produces its young from an egg. The affinities between birds and reptiles were referred to, and the probable origin from the reptiles considered. The plumage of birds is one of their greatest charms. When the female is bright colored, the male invariably incubates. The various modes of nest-building were dwelt upon at length, especial reference being made to the Mound Turkeys of Australasia. The birds assemble and build a mound of sticks, leaves and earth from eight to ten feet high. In this mass several females lay their eggs and cover them over, leaving a cup-like depression at the apex. This depression catches the rain, which, passing down into the heap, produces fermentation and forms a natural incubator. Descriptions of the Dinornis, the Apteryx and the Dodo were given. The migrations of birds were referred to, as well as the superstitions connected with them.

BOTANY LECTURES.

At the March meeting of the Executive Board of the Society, it was decided to begin a course of instruction in practical botany under Prof. Joseph F. James. This course will be open to the members and to twenty-five invited teachers of the public schools. It will begin about the middle of April, and continue for ten weeks. The sessions will be held in the rooms of the Society on Saturday mornings from 10.30 to 11.30. The leader of the class will furnish the fresh specimens, which will be analyzed under his instruction. The course will be open to members and the invited teachers *only*, and the instruction is free of charge. Should this course prove successful, others, on different branches of science, will be arranged in the fall.

Vol. VIII. No. 3.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee.

JAMES W. ABERT. WALTER A. DUN.
RAPHAEL BENJAMIN. WM. HUBBELL FISHER.
JOSEPH F. JAMES.

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OF THE

Cincinnati Society of Natural History.

VOL. VIII. CINCINNATI, OCTOBER, 1885. No. 3.

PROCEEDINGS OF THE SOCIETY.

MEETING OF *July* 7, 1885.

PRESIDENT HARPER in the chair, and fourteen members present.

Dr. James A. Henshall and Geo. Schneider were elected to regular membership.

The following papers were read and referred to the Publishing Committee:

REMARKS ON A SUPPOSED FOSSIL FUNGUS FROM THE COAL MEASURES.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

On October 19, 1877, Professor Leo Lesquereux read a paper before the American Philosophical Society of Philadelphia, afterward published in Vol. XVII (p. 173) of their "Proceedings," on "A species of Fungus recently discovered in the Shales of the Darlington Coal Bed (Lower Productive Coal Measures, Alleghany River Series) at Cannelton, Beaver Co., Pennsylvania." After referring to a supposed species of fossil fungus described by Lindley & Hutton, in 1831–'33, under the name of *Polyporites Bowmanni*, Prof. Lesquereux calls attention to certain similar fragments found in the Anthracite measures in Pennsylvania, and adds: that "There are in the Tertiary Lignitic of the Rocky Mountains some

[NOTE.—Through an oversight the following was omitted from the proceedings of the meeting of June 2.]

Messrs. Karl Langenbeck and H. C. Fithian were elected regular members of the Society.

The names of Dr. James A. Henshall and Mr. George Schneider were proposed for membership.

clay beds associated with coal, wherein are intercallated shaly fragments, colored in concentric zones by penetration of iron in such a way that they exactly represent the appearance of the fossils described by the English Authors. The zones, about two millemetres wide, are of different hardness, and the soft white ones being easily disintegrated, they form a series of alternately elevated and depressed bands, similar to those described as characters of the *Polyporites* of the coal."

Having thus disposed of the only form ever previously referred to Fungi*, he goes on to describe under the name of *Rhizomorpha Sigillariæ*, a specimen found in the Coal Measures of Pennsylvania which he considers a fungus. It was found under the bark of a species of *Sigillaria*, and is described as having an irregularly formed stem, "round, polygonal, elongated and linear, or amorphous," with diverging simple or forked branches, club-shaped toward the ends, or flattened by compression.

Some time since, I read before this Society† a paper on the "Fucoids of the Cincinnati Group," in which I endeavored to show that none of the so-called marine plants found in this locality were of a vegetable nature; but that they are referable either to inorganic causes, such as water washings, or to tracks, trails, Graptolites, or impressions of organisms. It is my opinion that the fossil under consideration has been erroneously referred to the vegetable kingdom; and that, instead, it should be regarded as a burrow made under the bark, where found, by some species of insect.

That it is not a vegetable is rendered probable from the fact that the mycelium of a fungus, which the fossil is supposed to be, is of a character little likely to be preserved. It is liable to decay in a short period, and even the spot it has occupied becomes indistinguishable from the rest of the wood. It is otherwise with an excavation made by an insect. This, living under the bark, eats it away along certain lines, and leaves behind a cavity which remains as a scar, and if the tree under the bark of which it has burrowed be preserved as a fossil, the burrow stands an equally good chance of preservation.

That the fossil considered is a larva burrow, is rendered still more probable when it is remembered that under the bark of living trees, similar excavations are found. Those made by species of *Scolytus* burrowing under the bark of species of Hickory, possess the same characteristics and appearances as the fossil. The main burrow is generally straight, although

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* In the "Bull. of Torrey Bot. Club" for June, 1885, (Vol. XII, p. 64) is a note on a fossil fungus found by Messrs. B. Renault and E. E. Bertrand in the tissues of the nucleus of *Sphærospermum oblongum*, of the Coal Measures. The fungus belonged among the Chytridiaceæ.

† See this JOURNAL, Vol. VII, pp. 124, 151. Oct., 1884—Jan., 1885.

frequently curved; the branches are diverging, generally simple, sometimes forked: are obtuse, club-shaped and flat. A comparison of the figure given by Lesquereux, with one given by Professor C. V. Riley in his fifth annual report as State Entomologist of Missouri, p. 103, will illustrate the resemblances between the fossil and the recent burrow. The burrows made by other species are still more like the fossil.

What now are the prospects of an insectivorous larva living under the bark of a *Sigillaria?* Were there any species living at the time and place where the fossil was found? In looking over a "Catalogue of Palæozoic Fossil Insects" compiled by Mr. R. D. Lacoe, and published in 1883, I find no less than five species out of a total of seventy-two fossil insects were found in the same locality as the fossil fungus (?), and in beds of the same age. As there is every probability that the habits of insects in past ages conform in many respects to those at the present time, it may be considered that they went through metamorphoses then as they do now: that the eggs hatched into grubs, the grubs fed, and then spun coccoons or formed the pupa cases, and finally emerged as perfect insects. There can be but little doubt that the *Rhizomorpha Sigillariæ* is the burrow left under the bark by the grub of some one of the species of insects flourishing at the time of the deposition of the coal.

A specimen of wood recently presented to this Society by Geo. W. Keck, has on it several of these burrows in an excellent state of preservation, and a few remarks as to how they are made may be of interest. Prof. Riley in the report referred to says, that both male and female insects bore into the tree just under the bark. A vertical chamber is excavated in which the female deposits her eggs, numbering from twenty to fifty. When the larvæ hatch, they bore in a horizontal direction, away from the central burrow, each in a distinct track, feeding on the inner bark. The perfect insect, a beetle, issues from a small hole in the bark, and the same cycle recurs. They are very destructive insects, and cause the death of whole groves of hickory trees. In Europe the elm is attacked in the same way. Perhaps in the ancient days insects of similar kinds were just as destructive to the forests, and in some cases have left their burrows to tell the story.

REMARKS ON SOME MARKINGS ON THE ROCKS OF THE CINCINNATI GROUP, DESCRIBED UNDER THE NAMES OF ORMATHICHNUS AND WALCOTTIA.

By Prof. Joseph F. James,

Custodian Cincinnati Society of Natural History.

The rocks forming the strata of the Cincinnati Group are full of markings which have either been neglected entirely, or else have been studied with erroneous ideas of their true nature. These markings are most common at the horizons where the rocks contain tracks and burrows which have been described as Fucoids. These have been shown* to be mostly inorganic in their origin, and while some are deserving of names, others are not. Other markings have also been described, sometimes from imperfect specimens, sometimes with an imperfect knowledge of how they were formed, or what they really represented.

Among the markings which have received attention, there are a number of genera (five) and species (eight) which have been figured and described in the Journal of the Cincinnati Society of Natural History, Vol. II, pages 217 to 222, by S. A. Miller. The author of the paper considers the species he describes to have been made on the "bed of an ocean having no great depth, but where the water was almost motionless, part of the time, and at others very slightly disturbed" (p. 217, 218).

Such a condition of affairs may be considered as nearly impossible. No ocean known is shallow and quiet at the same time, so quiet as not to destroy marks which may have been made in very fine sediment. Some of these markings, as described, are so delicate that the slightest movement of the water would suffice to erase them; and others are of such a character that the movement of water is necessary for their production. Instead, therefore, of regarding them as produced at the bottom of a shallow sea, it would be more reasonable to consider them as having been produced on exposed surfaces of mud, and in such proximity to the water that deposits of mud would preserve them for future ages.

One of these reputed tracks received the name of

Ormathichnus, Miller.

The genus "consists of a single, continuous, beaded track or trail."

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* Journal Cincinnati Society of Natural History, Vol. VII, pp. 124, 151.

One species, *O. moniliformis* was described and figured. The author remarks that it resembles "somewhat the impression made by a small column of *Heterocrinus simplex*, though longer beaded." It was supposed to have been made by a Gasteropod, though there can now be little doubt but that it was really made by a crinoid stem.

On slabs of rock bearing impressions referable to this species, there are often found curious waved and curved lines running parallel with each other, and sometimes covering considerable spaces of the rock. Occasionally at one end of the chain will be noticed a widening out. Here is the first indication of the source of the mark. It has been made by the stem of a crinoid, which, fastened at one end, and resting on the mud, has been moved to and fro by the water, and has thus left a trail. Each one of the divisions of the column has scooped out a depression. The further from the attached end, the wider will be the mark. The interruptions, in some instances, indicate that the stem has only at times touched the mud surface, while at other times the marks having once been made were destroyed by currents of water.

On the slabs containing these marks, fragments of crinoid stems are sometimes found. Often the marks imitate the stem so exactly that it requires close inspection to see their true character. But the real origin of the marks is conclusively shown in a specimen found near Cincinnati and in one found in the upper part of the Group (Clinton county, O.) by Mr. U. P. James. This last specimen is six or eight inches long, of very compact limestone, having on it one of these trails. The trail is about three inches wide at one end, and the center is scooped out into a hollow about half an inch deep. At the lower end is the crinoid stem, or part of it, which made the mark. The hollow is marked with curved parallel lines, each line as far from the next one as are the joints of the column. It is quite evident that the hollow has been formed by the sweeping to and fro of the stem, and the ridges indicate the situation of the joints.

Another of the ill-defined and obscure fossils which have been described, has received the name of

WALCOTTIA, Miller & Dyer.

The genus was described in the JOURNAL of the Cincinnati Society of Natural History, Vol. I, page 39. It was considered to be an annelid. It consists of "long, tapering, rugose, flexuous bodies, worm-like in form." "The fossils taper to a point at one end, and are enlarged at the other, or present the appearance of suddenly bending down and entering the rock."

The authors were uncertain as to the affinities of this fossil, but thought it probable it was the "long lost borer of Silurian Age."

Three species of this genus have been described, viz.: *W. rugosa*, M. & D., *W. cookana*, M. & D., and *W. sulcata*, James. The first of these is represented as a flexuous body with ridges in pairs, one on each side of the body, and forming an angle with each other on top of the body. It seems to be the impression of the under side of the flexible arm of a star-fish, rather than any distinct organism.

The second species, *W. cookana*, M. & D., is smaller, with the ridges less evident, and in no way so marked as the first. It is, apparently, the impression of some portion of a crinoid, either a part of the stem or one of the fingers.

The third species, *W. sulcata*, James, is much larger than either of the others. It is longer, thicker, with a depression running along the centre, and a few obscure markings along either edge. This mark, different from either of the others, seems to be a burrow.

Only a few specimens of these obscure fossils have been found. The figures show no structure whatever, the descriptions make no mention of any. They have but little definite form, and different specimens of the same species present many variations; in fact, no two are alike. Whatever else they may be, it is very questionable if they are the remains of worms, those perishable organisms without signs of a skeleton of any sort which could be preserved; without appendages by means of which they could leave impressions on the mud; without structure which is capable of resisting the process of decomposition. Further, these marks are found on surfaces which have obviously been exposed to atmospheric agencies, and are also in situations where there is the least possible probability of their being preserved from decay. Had they possessed a solid internal framework or appendages likely to leave an impress on the mud, there might be some ground for referring the marks to the remains of worms, or at least organisms. Annelids possess none of these, and as the specimens show no signs of any structure, it is safe to consign the genus with its species to the limbo of the improbable, and wipe from the catalogues three more useless names.

"Notes on the Tertiary of Alabama and Mississippi, with Descriptions of New Species," by T. H. Aldrich. "Notes on Tertiary Fossils, Rare or Little Known," by T. H. Aldrich. Both these papers were published in the July number of the JOURNAL.

The donations for the month were as follows: from G. H. Curtis, two microscopic slides; from F. W. Putnam, two pamphlets; from J. S. Newberry, one pamphlet; from Walter A. Dun, one pamphlet; from Signal Service Officer, "Monthly Weather Review" for April, 1885; from S. T. Carley, three specimens of *Liparis lilliifolia*, and a box of fossils from Sumpter Co., Alabama; from Smithsonian Institution, "Pro. U. S. Nat. Museum," Vol. VIII, Nos. 6 to 11; from Geo. W. Keck, specimen of wood with larvæ burrows; from Jos. F. James, specimens of Holly wood; from Director of the U. S. Geol. Survey, Vol. VI of Monographs; from T. H. Wise, one pamphlet; from A. R. Crandall, nine maps of Geol. Survey of Kentucky; from A. B. Carnahan, one Indian relic.

MEETING OF *August* 4, 1885.

MR. CHAS. DURY in the chair, president *pro tem.*, and ten members present.

The following paper was read and referred to the Publishing Committee:

REMARKS ON THE GENERA LEPIDOLITES, ANOMALOIDES, ISCHADITES AND RECEPTACULITES, FROM THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

In the JOURNAL of the Cincinnati Society of Natural History, Vol. II, page 20, there was characterized by Mr. E. O. Ulrich a genus of fossils under the name of *Lepidolites*. The specimens upon which the genus was founded were obtained near Covington, Ky., in the shales of the lower part of the Cincinnati Group. "They consist," the author says, "of much flattened calcareous bodies, which in their original state must have had, in the type species, a sub-spherical and in the other species a sub-cylindrical form." They were hollow, and the outer surface was covered with small plates or scales over-lapping one another.

L. dickhauti was described as having been flattened from a sub-spherical or sub-pyriform shape, with an indentation at the bottom. The scales on the outside were imbricated, "with the exposed margin rounded, and arranged in concentric lines, crossing each other in a quincuncial manner." "The appearance presented by a specimen that is flattened vertically, is very like that style of ornamental work on watch cases called 'rose-

engine turning.'" "Detached plates have a length that is equal to about three times the greatest breadth, and are somewhat cuneiform in outline, the widest end being that which is exposed." The lower side of each plate is provided with a longitudinal furrow.

L. elongatus differs chiefly from the type in being sub-cylindrical instead of sub-spherical, though the arrangement of the plates is the same.

In his remarks on the possible position of the genus, the author considers that these fossils cannot be referred to the echinodermata, "on account of the absence of openings, or of any series of plates that might be termed ambulacra." He further says that it seems related in certain character to *Pasceolus*, itself of an uncertain position, but considered by some a Cystidian, and by others a sponge.

I propose to show the identity of these two species to a genus of the order RECEPTACULIDÆ, belonging to the sponges.

The genera comprising the order are four, viz: ISCHADITES, Murchison, 1839 (Siluria, p. 697); SPHÆROSPONGIA, Pengelly, 1861 (Geologist IV, p. 340); ACANTHOCHONIA, Hinde, 1884 (Q. J. G. Soc., No. 160, p. 819); and RECEPTACULITES, Defrance, 1827 (Dict. Sci. Nat., t. 45, atlas, p. 68). Though now generally referred to the sponges, the order has been frequently placed with the Foraminifera, but the arguments for and against its position with the sponges must be neglected here, and the student referred to a paper on the subject by Dr. G. J. Hinde, published in the Quar. Jour. of Geol. Soc. of London, Nov., 1884, p. 395 *et seq.*

The genus ISCHADITES was first described by Murchison in 1839, in his "Siluria," p. 697. In the type species the general form varies from ovate to bi-convex or conical; "some are sub-spherical, and others pyriform." (Hinde, *l. c.*, 811.) The central zone is either bulged out, or the contour is rounded from base to summit. The base may be obtusely conical, flattened or concave. The outer surface has a number of plates, thickest in the central portion, but diminishing toward the margins, where they are very thin. They are generally rhomboidal. "The manner," says Dr. Hinde (*l. c.*, p. 812) "in which the spicular plates are arranged on the surface of the organism forms its most conspicuous feature. They are disposed in regular spiral curves which, starting in opposite directions, from the basal nucleus, and extending to the summit, give to the surface the exact appearance of the engine turned case of a watch." "As a rule, the margins of the plates appear to fit closely and evenly to each other, * * * * * but in some cases the upper or front margins seem to be slightly elevated, as if they imbricated over the lower or hind margins of the spicular plates immediately in front."

The points of resemblance between Mr. Ulrich's genus *Lepidolites* and *Ischadites*, are numerous enough to place the former in the latter, yet earlier characterized genus. The sub-pyriform or sub-conical shape, the overlapping plates, and their concentric "engine-turning" arrangement are features common to both. Considering, therefore, that *Lepidolites* was described forty years after *Ischadites*, it seems best to call the two species credited to the former genus

ISCHADITES DICKHAUTI, Ulrich.

ISCHADITES ELONGATUS, Ulrich.

Another genus, the position of which in classification has been a matter of conjecture, was described in the Jour. Cin. Soc. Nat. Hist, Vol. I, p. 92, as

ANOMALOIDES, Ulrich. 1878.

The fossils for which this name was proposed are described as "hollow, compressed, conical bodies." They were found "to have no surface which can be called ventral or dorsal, since they are composed uniformly of elongated, cylindrical, spine-like bodies, which are placed parallel with each other and perpendicular to the surface." These bodies are further described as "club-shaped stems," with their inner ends acutely pointed, while the end showing on the exterior is rounded, and has a minute pit. "The distribution of these club-shaped plates is very regular, being arranged in curved or flexuous transverse and diagonally intersecting lines." In other words the engine-turned arrangement of *Ischadites*.

Now the genus RECEPTACULITES was defined by Defrance as long ago as 1827. Species have been described from the Silurian of America and Australia, and from the Devonian of Belgium. In *R. occidentalis*, Salter (Can. Org. Remains Decade I, p. 43), the arrangement of the plates on the outside of the fossil is described as radiating "in curved lines, crossing like the engine-turned ornaments of a watch." Further, it appears that these lines are caused by the peculiar arrangement of a great number of spine-like bodies, arranged perpendicularly to the surface. That the inside is hollow, and that it is often pressed out of shape from a sphere to a cylindrical body. Fig. 2 (Pl. 10) given by Salter (Ibid), shows the outside of a weathered specimen and it is very similar in appearance to Mr. Ulrich's figure. (Pl. 4, figs. 6, 6 *a b*, J. C. Soc. Nat. Hist., Vol. I).

As there is, then, in *Anomaloides* more resemblance to *Receptaculites* than difference from it; as both possess the spine-like bodies, both are

hollow, and the "engine-turning" arrangement of the plates is the same, I propose that in the future *Anomaloides reticulatus* be placed in the genus to which it properly belongs, and be known as RECEPTACULITES RETICULATUS, Ulrich.

Mr. Geo. B. Twitchell spoke of the Flora of the Tyler-Davidson fountain and was requested to prepare a report for the next meeting.

Donations were announced as follows: from Dr. J. A. Henshall, "Book of the Black Bass;" from J. Kelly O'Neall, tooth of *Elephas Americanus:* from Director of U. S. Geol. Survey, Vol. VII of Monographs; from Smithsonian Institution, Vols. 24 and 25 "Contributions to Knowledge;" from Col. Chas. Whittlesey, two pamphlets; from Chief Signal Officer, Monthly Weather Review, May 1885; from Persifor Frazer, one pamphlet; from Bureau of Education, one pamphlet; from U. S. Nat. Museum, "Proceedings," Vol. VIII, Nos. 12 to 18; plates 1 to 14; from W. Shepard, one Indian stone ax; from Chas. Dury, Black Snake in alcohol and specimens of *Cicada septemdecim;* from J. Mickleborough, specimen of *Oreaster gigas.*

MEETING OF *September* 1, 1885.

PRESIDENT HARPER in the chair, and fifteen members present.

The following papers were read and referred to the Publishing Committee:

THE LIFE IN THE TYLER-DAVIDSON FOUNTAIN.

BY GEO. B. TWITCHELL.

On the evening of our last meeting, in passing the Fifth street fountain, I noticed an Alga growing in great abundance about the edge of the basin.

The unusual circumstances under which the plant was growing led me to make an examination. I collected a small amount and this, under the Society's microscope proved to be so full of life of all kinds that it was thought a full account might prove of interest. This work was given to me. For the past month, with the aid of other members of the Society, I have made observations on this life. These I now offer to the Society.

The collections were almost all made from the large basin and from a small basin under one of the drinking founts. The others yielded but little of any interest. It is quite a noteworthy fact that the faunæ and

floræ of these two basins were almost totally distinct. The large basin yielded (exclusive of diatoms) but one plant—the *Stigeoclonium*—and a great variety of animal life; while in the small basin were found all the other species of filamentous Algæ, a great variety of diatoms, no specimens of *Stigeoclonium*, and but little animal life and that of a low order. This difference was all the more remarkable as the natural conditions, other than that of body of water, in the two basins, were apparently identical.

The highest representative of animal life observed was the little Gasteropod—*Physa heterostrophia*, Say. This creature, I am sorry to say, has since been exterminated. (I mean in the fountain.) The fountain was cleaned soon after my first collection, and since then I have found none. However, they will soon grow again. In among the Algæ were found great numbers of Entomostracans—water fleas—skipping about in every direction. Notable among these, although not very plentiful, were the slender *Cyclops* with their two sacs of eggs. Then the *Cythere* and closely allied *Cypris*, but most abundant and prominent was the *Daphnia*. And surely it is quite right and proper that our modern daughter of the Peneius should take up her abode in our beautiful fountain, rather than in the dirty ditches she so delights in.

Worms were not plentiful: occasionally an *Aquillula* would be seen twisting in and out among the Algæ, and in one collection a lot of Rotifers were found making things lively for the smaller animalculæ.

I was quite astonished to find here a few *Euglenæ*, usually found only in stagnant water. It was not the species that is found in such abundance as to color the water, but the solitary one. In the same collection was found a *Vorticella*. This is by no means all the animal life to be found, but it is all that my objective could make out with any degree of certainty.

Among the plants, as one would naturally suppose, the diatoms were most abundant. Particularly in the small basin; species of *Navicula*, *Nitzchia*, *Pinnularia*, and the graceful *Pleurosigma* were found in great profusion while the *Meridion* and the *Gomphonema* were by no means rare.

Considering the size of the basin and purity of the water the number of species of filamentous Algæ was remarkably large. Fringing the wall of the small basin were masses of *Spirogyra* belonging to two species. Uufortunately the season was too far advanced to find the plant in fruit; but the strongly vegetating, bright green filaments were in the very best condition for showing the beautiful spiral arrangement of the chlorophyl. Here I also found a little mass of *Oscillaria limosa* and a single filament of a larger species. Although to the naked eye by no means an inviting object, yet under the microscope, on account of its wonderful motion, this

dirty green scum becomes one of our most interesting plants. The small basin, strange to say, yielded also desmids of the genera *Closterium* and *Cosmarium*, making a most remarkable flora for a body of water not over two and a half feet in diameter.

We now come to the plant that grew so profusely in the large basin and first drew my attention to the new collecting field. This was the *Stigeoclonium tenue*, Ag. It was found fringing the whole outer wall of the basin, in some places extending over two inches into the water. On the base of the fountain was another mass of what I supposed to be the same although I could not get at it to make a closer examination.

Under the microscope the slimy green substance collected becomes a mass of beautiful branching filaments, made up of many cells. Each cell contains chlorophyl, in vegetating filaments arranged in an irregular stellate mass not quite reaching the ends of the cells. In younger specimens this is not so apparent, while in filaments forming spores the entire cell is filled. I was fortunate enough to see this fruiting. The spores were formed in main filaments frequently between branches that had far outgrown the parent, which probably stopped growing when the formation commenced. The filaments would become constricted at the cell walls and the contents of each cell would form a single zoospore which eventually broke away, leaving the empty cell very delicate and very hard to see. In one collection that I made these spores were forming so rapidly that every dip would bring up hundreds of them. We have, in all, some six or eight species of *Stigeoclonium*, very hard to distinguish, however. I have found but one other in our waters, that in a ditch in Sedamsville.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

BY A. P. MORGAN.

[*Continued from Vol. VIII, p.* 110.]

GENUS II. POLYPORUS, FR. (Continued).

V. RESUPINATI.

Pileus none, the fungus therefore absolutely resupinate; the pores placed immediately upon the wood or the mycelium, seldom with an interposed subiculum.

A. Pores colored.

a. brown or blackish.

63. P. spissus, Fr. Widely effused, perennial, very hard, immersed, cinereous-brown; the margin very narrow, inflexed. Pores minute, angular, obtuse, entire.

In woods on the underside of hard trunks and branches, such as Hickory; common. Of a hard woody texture and sometimes effused to an extent of many feet; in specimens more than a year old, the annual strata are very distinct. The pores are brown within but the mouths are cinereous; they measure .16 mm. in average diameter.

64. P. obliquus, Pers. Widely ambient, annual, hard, very thick, uneven, pallid then brown and blackish; commonly encircled with an erect crested border. Pores long, oblique, minute, obtuse, angular.

On dead standing trunks of Ironwood (Ostrya); not common. Of a woody texture, very thick and uneven, and in its perfection of the elegant chocolate-brown color that Mr. Berkeley speaks of in the Cuban Fungi. The growth does not decorticate the Ostrya but the long oblique pores penetrate to the wood and seem to involve the bark in their substance. The pores at first are lined with a minute whitish down which gives the pale color to the surface; their average diameter, including the dissepiments, is .18 mm., but the latter are very thick.

65. P. niger, Berk. Effused, hard, rather thick, even, black; the border slightly raised, pubescent, dark brown. Pores minute, round, thin, umber within, the mouth very minutely black-tomentose.

On rotten trunks; rare. Elongated and altogether resupinate except at the very edge, where it is slightly raised, dark brown and pubescent; the substance where it is not quite obsolete, dark brown. Inside of the tubes dark brown but the hynenium jet black.

66. P. unitus, Pers. Effused, even, firm, dry, bright brown; the border thin, depressed, concolorous. Pores very small, thin, angular, acute, unequal.

In woods on old branches; rare. The whole fungus composed of a thin stratum of pores closely adnate to the wood and of a uniform clear brown color throughout. The pores themselves are larger than in the preceding species but the dissepiments are very thin so that the average diameter is about the same, .17 mm.

b. ferruginous or cinnamon.

67. P. ferruginosus, Schrad. Effused, thick, firm, uneven,

tawny, when mature brownish-ferruginous, with a sterile border. Pores medium, very long, subrotund and lacerate, cinnamon.

In woods on trunks and branches; common. The younger specimens are tawny and the older brownish; it is distinguished by its unequal thickness and consequent interrupted and uneven surface. The pores are commonly oblique and very long, measuring .21–.24 mm. in diameter.

68. P. CONTIGUUS, Pers. Effused, thick, firm, glabrous, submarginate, cinnamon when young; the margin villous from the first. Pores rather large, equal, obtuse, entire.

A resupinate form growing commonly on the underside of dead and dry stems of Papaw, (Asimina), is rather doubtfully referred to this species; the same is found on the bark of Ailanthus. The pores are large .38 mm. in diameter, angular, with thin dentate dissepiments.

c. red or purplish.

69. P. PURPUREUS, Fr. Widely and irregularly effused; mycelium mucedinous, flocculose, white, creeping through the surface of the rotten wood. Pores short, minute, unequal, scattered interruptedly or conglomerate, purple-lilac.

On bark and wood of Sugar Maple; rare. Thin and delicate, occurring in straggling patches, with groups of purple pores on the white mycelium. Some of the preserved specimens have bleached out white. It is *P. lilacinus*, Schw.

70. P. ATTENUATUS, Peck. Effused, thin, even, coriaceous, seceding, pinkish-ochre; the border pubescent, whitish. Pores minute, subrotund, thin, acute.

In woods on old trunks; not rare. Effused sometimes for many inches. The minute pores are spread evenly over the very thin whitish subiculum, which is separable from the matrix. The pores might, perhaps, be called subangular as well as subrotund; they measure about .14 mm. in diameter. This is a very beautiful species; it may be *P. vinctus*, Berk.

71. P. RUFUS, Schrad. Effused, coriaceous, thin, adnate, even, glabrous, determinate, dark red. Pores minute, thin, acute.

On old prostrate trunks; common. Specimens which agree with it quite well in color are doubtfully referred to this species; they appear rather humid, and the substance consequently rather fleshy to come under the designation *coriaceous;* the pores too, when fresh, are obtuse, though they may be called *thin* when dry. *P. hæmatodes*, Rostk. is said to be the same thing.

d. yellowish.

72. P. VITELLINUS, Schw. Widely effused, loosely adnate, thick, uneven, soft and fleshy, vitelline, with a byssine margin. Pores very large, elevated, unequal, thin, angular.

On very rotten wood. A soft and fleshy fungus of unequal thickness and large unequal pores. The color is very elegant and persists even in drying; the egg-yellow pervades the whole mass. The long pores vary from round to angular and even sinuous. Strings of yellow mycelium penetrate the rotten wood beneath.

73. P. XANTHOLOMA, Schw. Widely effused, closely adnate, even, smooth, dry; the border rather broad, velvety, yellowish. Pores minute, unequal, subrotund, obtuse, pale yellowish.

Common in woods. Effused often to the extent of many inches or even several feet on the underside of sticks or smaller branches lying somewhat up from the ground and keeping it dry. The border is sometimes "elegantly luteous" and therefore of a deeper yellow than the pores but this is not always the case. The pores at first are pale, maturing into a rich cream-color; they are mostly roundish but vary to oblong and subsinuous; the dissepiments are thick and obtuse; they average .16 mm. in diameter.

74. P. BOMBYCINUS, Fr. Effused, silky-membranaceous, loosely adherent, sordid yellowish, with a cobwebby-velvety border. Pores ample, angulate.

On an old rotten log of Sugar Maple; rare. A very distinct and singular species. It first appears as subrotund byssine spots, soon forming in the center a porose hymenium, these then become confluent into a soft rather thick membrane. The pores originate as little pits sunk in the mycelium out of which they are wholly developed, being at first subrotund, then growing firmer they become angular and sometimes flexuous. The dried specimens have taken on a brownish hue and the dissepiments are very thin, dentate and lacerate. *P. subiculosus*, Peck, seems not much different from the primordial state of this species.

e. cinereous.

75. P. CINEREUS, Schw. Widely effused, adnate, firm; the border narrow, thin white-fimbriate. Pores small, unequal, subrotund, obtuse, cinereous.

In woods on the lower side of old logs; common. The whole of a uniform ashen hue except the minute whitish fringe of the border. The

growing specimens are somewhat moist, but they shrink little in drying and become quite firm. The pores measure about .20 mm. in diameter. It is an elegant species.

B. PORES WHITE.

f. minute, round, obtuse.

76. P. VITREUS, Pers. Effused, subundulate, indeterminate, whitish, subhyaline; the mycelium a tough, separable, subcoriaceous membrane. Pores minute, round, long, obtuse, entire.

Upon rotten prostrate trunks of Beech; rare. A very remarkable species, which has given rise to other genera; *Poria vitrea*, Pers.; the sterile leathery mycelium without any pores, *Xylostroma candidum*, Pers. The stratum of long pores is soft as if fleshy; it is often interrupted or the pores collected in nodules. The Xylostroma is usually found between the bark and the wood.

77. P. OBDUCENS, Pers. Effused, incrusting, innate, firm, white, formed wholly of the pores. Pores minute, crowded, equal, distinctly stratified, the older strata pale alutaceous.

On the underside of old trunks; common. The first year it consists of a thin white separable stratum of crowded pores, which, however, in drying takes on the pale alutaceous color of the succeeding years. It is rather humid when young and differs decidedly from *P. vulgaris*, which is always dry and inseparable.

78. P. VULGARIS, Fr. Widely effused, thin, dry, closely adnate, even, white; the border soon glabrous. Pores firm, crowded, small, round, nearly equal.

On wood of all sorts; common. Consisting of a thin dry stratum of minute pores, sometimes on hard dry wood. The variety *flavus*, Fr., is not uncommon and the *white* and *yellow* sometimes occur in the same specimen; this is probably *P. pulchellus*, Schw. The pores are roundish with rather thick dissepiments; they measure about .16 mm. in diameter.

g. small, angular, acute.

79. P. MUCIDUS, Pers. Effused, rather thick, somewhat immersed, soft, white, becoming pallid; the border indeterminate, byssine. Pores medium, unequal, lacerate, received in a crustaceous mycelium.

Upon old rotten wood; rare. At first soft and somewhat fleshy. Pores becoming thin, angulate and torn, measuring about .20 mm. in diameter.

80. P. MOLLUSENS, Fr. Effused, thin, soft, white; the border

byssine, fibrillose-radiating. Pores in the center or collected here and there, small, thin, round, unequal, lacerate, becoming pallid.

Upon rotten wood, leaves, etc. Thinner and much more delicate than the preceding; to be distinguished by its pores scattered in patches upon a byssine mycelium with a fibrillose border.

81. P. VIRIDANS, B. & Br. Effused, crustaceous-adnate, thin, at first white, afterward, when dry, pale green; the margin pulverulent-tomentose. Pores minute, angular, the dissepiments thin.

In woods on the lower side of old trunks; rare. This is a very beautiful species. It is at first and when growing all white, but in drying the pores take on a pale green tint, leaving, however, a pure white sterile border, elegantly puberulent and fimbriate. It is at first a little humid and seems to be furnished with a subcoriaceous subiculum, which is closely adnate to the wood. The thin dissepiments of the pores are in no wise toothed or torn. The pores measure about .18 mm. in diameter.

82. P. GORDONIENSIS, B. & Br. Effused, membranaceaus, very thin, separable, persistently white; the margin shortly fimbriate. Pores minute, unequal, angulate; the dissepiments very thin, fimbriate-denate.

In woods on old trunks of Elm; rare. At first apparently somewhat fleshy, when dry, becoming extremely thin and delicate. The dried specimens scarcely show the elegantly fringed teeth of the pores. It was first found in Great Britain on Fir; it is recorded in the New York Reports by Prof. Chas. H. Peck.

h. large, angular, unequal.

83. P. VAPORARIUS, Pers. Effused, innate; the mycelium creeping in the wood, floccose, white. Pores large, angulate, white, becoming pallid, crowded together into a contiguous, firm, persistent stratum.

On bark and wood of all kinds; common. This is an extremely variable species in its appearance. The pores at first are angular and about .32 mm. in diameter; their dissepiments soon break and the pores become compound and labyrinthiform. In a very oblique position it, at first sight, appears a Hydnum, but the teeth are terete and a close inspection shows they are pores split on one side. There is no border, but a thin white mycelium creeps close in the surface of the wood and bark. The white color soon becomes stained and rusty. *P. papyraceus*, Schw., growing on dead grapevines, is said not to be different.

84. P. TENUIS, Schw. Long and longitudinally effused, forming a thin subseparable white-palish equable membrane, the margin somewhat sterile and whitish. Pores quite large, subflexuous, shallow, pallid.

"On a dead stick." This is given on the faith of Berkeley, in Lea's

catalogue; I have never met with anything I could so refer. The original habitat, given by Schweinitz, is on the fibrous inner bark of Chestnut.

85. P. CANDIDISSIMUS, Schw. Effused; the mycelium, a very thin, bombycine, but separable membrane. Pores very large, at length oblique, and with the membrane pure white.

In woods on the bark of an old Hickory log, effused for many feet. At first, when fresh and growing, quite soft and fleshy; the pores very large and angular, at first shallow, lengthen and become oblique. The pores present an uneven surface, or are grouped in patches upon the firm membrane. It resembles most *P. molluscus*, but the pores are very much larger. The pure white color is very marked.

i. superficial, distant, punctiform.

86. P. CORTICOLA, Fr. Very broadly effused, equable, firm, white or palish; the mycelium interwoven into a naked subcoriaceous stratum. Pores naked, superficial, commonly obsolete, punctiform.

Upon barks. On account of their habit altogether similar, there are embraced under this name many different forms. Perhaps all are only degenerations of other species; the substerile pores differ greatly in the degree of their evolution.

GENUS II.* MYRIADOPORUS, Peck.

Hymenium cellular, porous. Pores of the surface shallow, open; the others imbedded in the hymenium, variously directed, short, closed, inseparable from each other, and from the hymenophora.

The pores do not, as in Polyporus, form vertical parallel tubes, but rather cells or short tubes variously directed, so that a vertical section of the hymenium, as well as a horizontal one, is porous. Fries mentions such a structure in the Elenchus I, 123; he describes it well, as follows: "In hoc contextus tatus *cellulosus*, incompletos poros format, eosque includit, unde totus fungus extus intusque vesiculosus!"

1. M. ADUSTUS, Peck. Resupinate, effused, thick, subcoriaceous, uneven; the subiculum thin, floccose, whitish. Hymenium thick, grayish black externally, varying to whitish internally, substratose; pores or cells minute, roundish, unequal.

In woods on the underside of an old trunk. Effused to the extent of several inches, about 2 mm. in thickness, the hymenium occupying much the larger part of the thickness. The genus is founded upon this species and *Polyporus induratus*, Peck, 31st Report, p. 37, so that at present there are but two described species.

The name of Dr. J. Taft was proposed for membership.

Mr. T. H. Aldrich spoke of the fact of sharks being caught in the fresh waters of Tombigbee river in Alabama, 125 miles from the mouth. The fish were often five and six feet in length.

Mr. Raphael Benjamin considered the fact a strange one, as he had often seen sharks in great numbers in Port Jackson Bay, Australia, and did not know of an instance in which they frequented fresh water.

Mr. A. P. Morgan donated fifty oil paintings of Fungi, 7 x 10 inches, with the remark that they had been painted by Mrs. Morgan, and exhibited in Boston and New Orleans; he now desired to present the same to the Society. The gift was received with applause.

Mr. Jos. F. James, the Custodian, spoke of the meeting of the American Association at Ann Arbor, and exhibited a few plants collected there. He also called attention to a set of thirty-eight photographs of scenery from the West, recently donated by the U. S. Geological survey.

The following amendment to the constitution was proposed by Dr. W. A. Dun: "That Article II of Section 6 of the By-Laws be amended by the addition of the words 'Photography and Meterorology' to the list of sections in the Society." This amendment comes up for discussion at the next meeting.

The donations of the month were announced as follows: from Nelson W. Perry, web of *Tenia zeæ*, from Mexico, (found in a granary of corn); from Director of U. S. Geological Survey, thirty-eight photographs of canon scenery; from Carlos Shepard, one *Pyrula* from mound on the Ohio river; from Chief Signal officer, "Monthly Weather Review," for June, 1885; from U. S. Fish Commission, "Bulletin," Vol. V, Nos. 7 to 21; from Smithsonian Instutition, "Report," for 1883; from A. P. Morgan, fifty paintings of Fungi; from T. H. Aldrich, twenty-four species of shells from New Zealand.

PETRIFIED HUMAN BONES FOUND IN A MOUND NEAR FORT HILL.

By Walter A. Dun, M. D.*

The specimens of bone† I present you this evening are a part of those recently taken from a mound near the earth works at the mouth of the Great Miami river by Mr. Carter Harrison. The unusual condition of these specimens deserves your careful notice.

I. In the first place, the bones are covered with a hard, stony deposit, thickest on the *anterior* surface, but shading off on the lateral surfaces, leaving the posterior surface nearly free from it. This stony material has, in some situations, penetrated the deeper layers and interstices of bony tissues, and caused true petrification—literally speaking; in places, too, this stony coat has reunited, by "stony union," pieces of fractured bone. This deposit consists of carbonate of lime (CaO, CO_2, or $CaCO_3$) mixed with particles of dirt and small pebbles, forming a kind of conglomerate mass, which shows well on one or two rough eminences. On portions of the deposit is a peculiar irregularly grooved and ridged condition presenting *almost* a reticulated, honey-comb appearance.

II. In the second place, the fractured condition of the bones presents interesting features. Laying aside those fractures, obviously produced in exhuming the skeletons and handling them since, it will be immediately seen that quite a number remain, which will be designated as *old fractures.* In closer examination, these old fractures present striking points of similarity: first, the anterior surfaces have borne the brunt of the cause; second, the force has been considerable and, apparently, applied suddenly at first, and thereafter acted continuously; third, the anterior surfaces are depressed, and in places impacted, the posterior being whole or merely fissured.

III. The condition of the bony tissue, itself, where not infiltrated with the carbonate of lime, gives the appearance of considerable age, crumbling quite easily under the finger, with marked absence of organic matter proper to the normal tissue. The calcareous deposit to the osseous tissue is about all that remains.

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*This paper was read before the Society in the Spring of 1880. In view of the fact that the account given relates to specimens in the Society's Museum, it is deemed well to place the paper upon record.—[Editor.]

†These specimens are now in the Museum of the Society.

IV. The details of the history of the excavations are promised the Society by Mr. Robert Brown, Jr., who furnished the necessary funds for it. Yet I take the liberty of placing here a few points which I got from Mr. Harrison in regard to the circumstances surrounding and the position of these skeletons. These points, labor under the difficulty of all "word of mouth," having been twice repeated, with considerable time intervening for play of memory, and lack the exactness of notes taken on the spot. However, if there has been no mistake, the appearances indicated that a vault occupied a position near the centre of the base of the mound; in this vault two complete skeletons were found laying on their backs, or quite nearly in that position, covered with pieces of rough, partially burnt limestone.

V. Having thus far considered the facts as they appear, the next endeavor will be to explain them, and not only account for these various phenomena, but connect them into a series, and show the order of their occurrence, and how their condition is due to natural causes acting on them and their immediate surroundings. Let us assume, then, that this mound was built over these bodies—how built? Probably in the usual way in mounds of similar character: first, the body placed in position, then the vault built around it and then the mound erected over it. In this instance the bodies were placed, likely, exactly where found, with the bones in a *whole* condition and covered with flesh. I do not think the fractures were produced before death, because quite a number of other bones of the same lot were crushed in similarly from the anterior surface, and even the upper part of the tibia, protected posteriorly as it is by soft parts, could not be so mashed and driven in anteriorly during life when the soft parts form such an unresisting base. The bones then were whole and covered with flesh; here time is required in the story. The flesh decays and at last is all gone; the bones begin to go, when some support of the vault has decayed and the stony roof falls upon the skeleton with sudden force, the bones are broken. Where? How? Broken on the anterior surface, for this surface is turned up, and consequently gets the shock. The surface, too, is cracked and driven in or the bone broken in pieces. The stony roof having thus fallen with a shock on the skeletons, it finds a resting place on them, and in turn is pressed on by dirt above. Degeneration of the bony tissue continued, but the constant pressure served to keep the splintered fragments together; there is room here for a difference of opinion in regard to the nature of the application of the force. It might be claimed that this fractured condition could result from pressure applied

continuously, as by the mere weight of the stone and earth over the skeletons. However, it must be remembered that a cubic inch of human bone will resist the crushing force of five thousand pounds, and that the dirt over a bone in a mound fifteen feet high would not weigh that much. It might be said that these bones had undergone considerable decay of animal matter and material weakening, and that a stone of some square foot or more surface, with the earth above, might press on a small area of bone tissue and thus cause the condition found. Admitting such a possibility, the condition itself is better satisfied by suddenly applied force, at first producing the transverse fissured fractures and then impacting in places in time, by constantly acting. Another point in this connected series of events relates to the deposit of carbonate of lime over the anterior and lateral surfaces of the bones. The deposit resulted from the water holding carbonic acid gas in solution dissolving the hydrate and carbonate of lime converting the hydrate into the carbonate, and dripping from the rocks above on the bones below, penetrating or soaking into the bones, the water then escaping leaving the salt of lime behind in the form of deposit on the bones, in a way similar to the formation of stalactites or stalagmites. That this deposit occurred after the fracturing, is shown by the deposit uniting the fractured fragments in some places. The peculiar grooved and ridged condition of the deposit on the bones, at first seemed to be caused by roots favoring the deposit in some places and hindering it in other places, yet I hardly think this is sufficient. This accounts then for the deposit, its nature, its place on the anterior and lateral surfaces, its relative place in the series of events; much could be added on the apparent age of these bones, yet I think enough has been said in this hasty review.

To recapitulate then: we have a dead body in a vault, time and natural causes produce decay, the falling in of the vault fractures the bones, and last, a stony deposit covers and petrifies them. Such seems to be the history of these petrifactions, yet minds see the same things in different lights. The specimens are before you inviting attention and study, and I shall be glad to alter or amend my present views when fact or the wisdom of age and experience can reasonably demand it.

CATALOGUE

OF THE

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OF THE

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COMPILED BY

JOSEPH F. JAMES,

Custodian and Librarian.

The following Catalogue embraces the books and pamphlets in the Library of the Cincinnati Society of Natural History. As much valuable and technical matter in science is now and has been published in the Journals and Transactions of Societies, full series of these are valuable for Scientific Libraries of reference. This Catalogue will show many defects in this direction, but these defects are being constantly remedied. New names of Societies are gradually being added to the exchange list of the Society. Most of the Academies and Societies in the United States and many of those in Europe now send their publications regularly to the Library. A large part of the scientific documents published by the Government are also sent regularly, and by these two means alone the Library is rapidly increasing in size and value. It is desirable to complete as far as possible the sets of Transactions and Proceedings of Learned Societies, and those Societies not already in correspondence with the Library, are solicited to open communication with the person in charge. Extras from authors are also desired. One of the objects of this Journal is to exchange with other Societies, and as quite a number of the previous volumes are still on hand, they will be gladly exchanged for volumes wanting in sets and for scientific books and periodicals. Societies from all countries which desire to exchange publications are requested to correspond with the Librarian as below.

JOSEPH F. JAMES, *Librarian*,

108 Broadway, Cincinnati, O., U. S. A.

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—— —— Origin of Mineral Veins. 1877. (Pamph.)
—— —— —— Mountain Chains. 1874. (Pamph.)
—— —— Physical Geology of Lake Superior. 1885. (Pamph.)
—— —— —— Structure of Ohio Coal Fields. 1876. (Pamph.)
—— —— Shiloh, Battle of. General Wallace's Division—Was it Tardy? 1875. (Pamph.)
—— —— Strata of Coal Region of Ohio. 1877. (Pamph.)
—— —— Palæontology and the Moral Sense. 1873. (Pamph.)
—— —— Rate of Increase of Human Race. 1874. (Pamph.)
—— —— Rivers In Mississippi Valley. 1874. (Pamph.)
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—— —— Hamilton Group in Ohio. 1874. (Pamph.)
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—— —— Parallelism of Devonian in Michigan and Ohio. 1876. (Pamph.)
—— —— Vegetable Remains in Drift Deposits of North West. 1875. (Pamph.)
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—— Iowa and Minnesota. (See Owen, D. D.)

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PROCEEDINGS OF THE SOCIETY.

MEETING OF *October* 6, 1885.

PRESIDENT HARPER in the chair and sixteen members present.

The following names were proposed for regular membership:

Chas. H. Allen, Jr.
Wm. Archer.
Wm. B. Burnet.
H. E. Bonshur.
Geo. Bullock.
Stephen S. Coles.
A. J. Carson.
John B. Clunet.
E. J. Carpenter.
W. C. Fiedeldey.
Prof. Thos. French.
John R. Froome.
Herman Groesbeck.
Telford Groesbeck.
Clarence Gilmore.
C. J. Harcourt.
D. W. Huntington.
J. W. Innes.
W. D. Innes.
Rankin D. Jones.
E. B. Johnson.
Chas. H. Kellogg, Jr.
H. N. Kitchell.
T. H. Kelley.
Nicholas Longworth.
Edmund Miller.
Geo. W. McLaughlin.
Geo. W. Pohlman.
L. M. Prince.
A. D. Smith.
Chas. H. Short.
Samuel W. Skinner.
Nelson Sayler.
Wm. Schultze.
John L. Stettinius.
Percy Thorpe.
H. H. Vail.
John Wiggins.
Harry Woods.
Jacob Workum.
John Yoakley.

Dr. J. Taft was elected a regular member.

The Amendment to add to Section 2 of Article VI of the By Laws, the words "Photography and Meteorology," came up for discussion.

In this discussion, Doctors Dun, Langdon, Young, and Heighway, and Mr. E. S. Comings took part. Dr. Young opposed the amendment, but the majority of the members present favoring it, it was carried.

Dr. O. D. Morton exhibited a "Gold Beetle" from Ceylon.

Mr. W. H. Knight showed a specimen of steel rolled to $\frac{1}{3000}$ of an inch in thickness. He inquired if any member could state how fine a line could be seen by the naked eye.

Dr. A. E. Heighway, Jr., stated that rulings on glass $\frac{1}{50000}$ of an inch apart could be seen.

Donations were announced as follows: From Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 19 to 31, and plates 15 to 19, 21, 22, 23. From Department of Interior, "Bulletin No. 27 of United States National Museum." From Western Reserve Historical Society, "Publication No. 66," July, 1885. From Chief Signal Officer, "Monthly Weather Review," July, 1885. From Mrs. M. C. Morehead, 20 species of marine Shells. From Prof. R. B. Warder, "Report of Indiana State Board of Health" for 1884. From George F. King, specimen of Feldspar Pseudomorph.

MEETING OF *November* 3, 1885.

PRESIDENT HARPER in the chair and nineteen members present.

The following papers were read and referred to the Publishing Committee:

REPORT ON MOUND EXPLORATION IN GREENE COUNTY, OHIO.

BY WALTER A. DUN, M. D.

About the middle of August, 1876, in company with Mr. T. J. Brown, now editor of the *Waynesville Chronicle*, I aided in exploring a mound in the Miami Valley, in Greene county, just north of the Warren county line. This mound was situated in a cleared stubble field which had been under cultivation for more than forty years. Between the constant plowing and rain the height of the mound had been considerably reduced, and the line of demarcation between the base and the original soil of the field in which it was situated was rendered very indistinct. By the best measurements we were able to make, the dimensions were as follows: Height five and one-half feet; diameter at the base sixty feet. We excavated a hole from the summit, ten feet long in a north and south direction, and four feet wide. On the very surface we found a barbed arrow point, similar to those which were found in the Deercreek mound.* Twenty inches below the surface an unfinished flat slate instrument was found, about five inches long by one inch wide with a wide rounded middle, and rounded edges. This instrument was not polished smoothly, but showed the long scratches of the material used to shape it. Charcoal and ashes in quantity surrounded with burnt clay, denoting a fire at that point, were found at the depth of four and one-half feet. A beautifully shaped arrow point was found at the depth of five feet resting upon the soil on which the mound was originally built. In the course of excavation one or two thin layers of sand were passed through. On one side of the hole were found undoubted traces of a previous opening. Mr. Brown assured me that the former owner of the place died a few years ago at an advanced age, and that he had told him that it had never been opened. The excavation which was made previous to ours was made a long time back because the earth which had been thrown back was packed as hard as any of the mound earth.

* See JOURNAL of the Cincinnati Society Natural History, Vol. VII, No. 4, Page 194.

In connection with this report, I wish to report upon the result of the excavation and examination of a number of graves situated on a bluff along the banks of the Scioto river, a mile or two below Yellowbud, in Ross Co., Ohio, which I investigated in July, 1876. There were fifteen or twenty of them scattered through a ten acre cornfield and watermelon patch. They were all circular, about twenty to twenty-five feet in diameter and about fifteen inches high. They were composed of a yellow sandy soil, differing very markedly from the black soil of the field, and in that portion of the field planted in melons, could be easily recognized by the difference in color. A number of these were examined a few days before I arrived, and copper, mica and stone ornaments were taken from them. Small pieces of mica with holes drilled in them, and many mica flakes were picked out of the loose earth of these previous excavations by me on my arrival. Copper beads and ornaments with many slips of mica and stone ornaments were shown to me as coming out of these graves. There were quantities of human bones taken out and found lying around loose. I found these hard and strong, and so firm and perfect that I could hardly bring myself to the belief that they dated back to the recent Indians. I examined a number of these graves in which I found nothing but human bones in a tolerable state of preservation. So far as I could learn, no articles of European make were ever found in these graves. I have alluded to these graves because they are apparently the beginning of mounds constructed recently, or else used as places of interment by the recent Indians. From my observations I would say they were constructed by our late Indians. Further than that, this locality is only a few miles north of "Mound City," that circular enclosure filled with so many mounds and the source of so much of the results of Squier and Davis' investigation. The mounds described by them were nearly all small, and the variations in size from those they report and those I now tell you about are so slight as to make one question the fact as to whether those of Mound City were not really Indian graves. It will also be remembered that the finest pieces of sculpturing, pipes, etc., which Squier and Davis describe, came from Mound City, so that this strikes a blow at once at the division of Mound Builders and Indians into separate races. I am compelled to say that I have long believed there is a difference, and that I am not yet convinced that there is not a difference. That the Mound Builders should be connected in some way with some of the people scattered from Alaska to Patagonia; and all called Indians, I will admit, but I do not believe we have proved them to be identical with our recent North American Indians, and there are numerous reasons to make me think they are not identical.

In answer to an inquiry, Dr. Dun stated that one of the reasons for assuming a distinction between the modern Indians and the Mound Builders, was the mathematical knowledge displayed in the construction of the mounds and earthworks, as well as the condition of mound-builder bones, as compared with Celtic remains of a known age in Europe.

Mr. J. R. Skinner stated that Col. Chas. Whittlesey had concluded from a study of ancient remains that thirty inches was probably the standard of measure of the Mound Builders.

OBSERVATIONS ON THE PERIODICAL CICADA.

By Walter A. Dun, M. D., M. R. C. S.

I desire to present to your notice a few observations which I recently had the opportunity of making on the Seventeen-year Locust in this locality.

The first place of observation was at Lindenthor, the residence of Dr. E. Williams, situated on the top of the hill range on the north side of the Ohio river, a couple of miles from the centre of the city. The locusts began to make their appearance there on Friday, May 28th, but only in small numbers. On Friday evening, immediately after a rain storm, which moistened the ground considerably and possibly aided the locusts to escape, they began to emerge from the ground in large numbers, and crawl to the trees. It is interesting to note the fact that they crawled up the tree often to as great a height as forty feet, and upon this Friday evening, sought the under surface of both limbs and leaves, where their shells were found the following morning. During Friday night and Saturday morning they emerged from their shells and remained about in a quiet way on the trees, apparently unable to make any exertion. Saturday, Sunday and Monday evenings, May 29th, 30th, and June 1st, respectively, similar hordes made their appearance, always late in the afternoon, and mostly they were shell free before morning. On these three later days, none of them being rainy, they never sought the under side of the leaves and boughs, but seemed always to seek the upper surfaces. Upon Tuesday, June 2d, a smaller quantity appeared. I left on Wednesday, so can not say anything about their subsequent coming there. Sunday, May 30th, they were first heard and their presence in force certified to, by the peculiar hum which began about sunrise and grad-

ually increased. I returned to Lindenthor June 18th, and found that the locusts were still there in a small quantity but that their hum was feeble. Quantities of wings and pieces of locusts could be found everywhere. Upon June 21st I was there again, and they had entirely disappeared. The new wood, which had their eggs deposited in them, was dying, and the beech trees seemed to have been specially selected. The limit of duration at this point was twenty-four (24) days. I observed the locusts at Middletown, Franklin, Miamisburg, and Dayton, and could hear their hum all along the C. C. C. & I. R. R. at stopping stations upon the afternoon of June 4th. At Dayton I saw them in quantity, but mostly on trees outside the town. I was told on Sunday, June 7th, that they had been there about a week.

Dr. G. S. Franklin, from Chillocothe, whom I met at Dayton, told me that these locusts abounded in Ross county and made their first appearance there during the last day or two in May. From Dayton I went northward, noting the locusts in Clark county, and arrived at Mechanicsburg, Champaign county, June 8th. The locusts had just begun to make their appearance there on that day. I staid in the north part of Madison county some days after that date before the locusts made any perceptible noise. The difference between their appearance here and there, being about 100 miles in latitude, seems to be marked by a variation of from ten days to two weeks. In fact, when I left there, June 16th, their noise seemed about as loud as that which I had heard in Cincinnati June 2d and near Dayton June 7th. While up in the county I made several trips in the country about, and found the locusts throughout Madison county, and in the eastern part of Champaign. I note in "Science" June 26th, 1885, that Prof. Riley gives the distribution to "The Periodical Cicada" in Ohio, as Green, Franklin, Pike, Columbiana and Miami counties, and the vicinity of Toledo.

To this list I desire to add the following: Hamilton, Butler, Montgomery, Clark, Madison, Champaign and Ross. I trust others in this society may be able to extend the district or aid in mapping it out correctly.

CEPHALOPODA OF THE CINCINNATI GROUP.

BY PROF. JOSEPH F. JAMES,

Custodian Cincinnati Society of Natural History.

The class CEPHALOPODA is represented in the rocks of the Cincinnati Group as exposed in this vicinity by six genera. Thirty-seven species and two varieties have been catalogued as found in the Group. The number given by the present writer is thirty-one species, which seem to be well characterized, two new species being described. The genus *Orthoceras* is the largest and has thirteen species. *Endoceras* and *Cyrtoceras* come next with five and six each. *Lituites* with four, *Colpoceras* with one and *Gomphoceras* with two. All but four of the species belong to the straight, longicone shells, the four species of *Lituites* being the only coiled ones.

The two orders into which the class is divided are best distinguished by the absence or presence of the external shell. All those species of which remains have been found in this locality were provided with an external shell, generally straight, divided into chambers called septa, each of which is connected with its neighbor by means of a tube known as the siphuncle. The animal lived in the outer chamber of the shell and formed a wall across the one behind it, in which it had before resided. The *Nautilidæ* or Nautilus Family is the only one now living of this order, the other two families, *Orthoceratidæ* and *Ammonitidæ*, being known only by fossil representatives.

Of the three families the *Orthoceratidæ* is the oldest, having representatives well developed in the lowest fossil bearing rocks. The *Ammonitidæ* is most common in the secondary formations, particularly the Cretaceous, Jurassic and Liassic, while the *Nautilidæ* ranges from the Lower Silurian age to modern times. Some species of *Orthoceras* attained a length of six feet, and some *Ammonites* were three feet in diameter.

Ammonites did and *Nautili* do float with the shell down and the tentacles expanded on the surface of the water, but creep on the bottom with the shell raised on the back. *Orthoceras*, on the other hand, is supposed by Woodward to have swum in a perpendicular position, head downwards. Whether they crept on the bottom with a six-foot tower on their backs can not now be determined.

It has long seemed to the writer a remarkable fact, that, in spite of the amount of palæontological work done by innumerable writers, so few attempts have been made to collect the scattered descriptions and render

them easily accessible to students. In the present paper the original descriptions of all the species have been consulted, and whenever possible, of the genera also. These last are often particularly difficult to find, but are, at the same time, of special importance to the student. There can be but little doubt but that many synonyms have been made, because of the inability to have all the descriptions together to compare. Others have resulted from considering small and individual differences as being worthy of specific rank. Still others from the fragmentary condition of the specimens described. All zoologists are aware of the variations produced in animal forms by varied conditions. But in geological studies these individual variations do not seem to be considered. Descriptions are made from single and often imperfect specimens. The occurrence of a fossil in another stratum has been thought, if there is the least variation, sufficient for a new name. While if found in another country it is seldom regarded as identical.

The present paper is offered as a contribution toward the complete collection of descriptions of the fossils of the Cincinnati Group. At the close of it will be found a brief bibliography of the works referred to.

Order CEPHALOPODA.

Family ORTHOCERATIDÆ.

Shell straight or curved; conical, or swollen at the chamber of habitation; siphuncle eccentric or central.*

SYNOPSIS OF GENERA.

Shell straight; conical; siphuncle mostly small and dilated between the chambers. ORTHOCERAS, 1.

Shell straight; conical; septa depressed on one side, arched on the other. COLPOCERAS, 2.

Shell straight; conical; siphuncle large, marked or ridged by the septa. ENDOCERAS, 3.

Shell fusiform or bottle-shaped. GOMPHOCERAS, 4.

Shell curved, or partly involute. CYRTOCERAS, 5.

Family NAUTILIDÆ.

Shell planorbiform; sutures simple; whorls (in our species) in contact. LITUITES, 6.

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* It should be understood that this definition is intended to cover only the species of this Group.

Genus I. ORTHOCERAS, Breynius. 1732.

De melonibus petrefactis montis Carmel. Miller, 1875, Cin. Quar. Jour. Sci., II, 124.

Shell conical, straight; greater part of posterior end traversed by convex, transverse septa; transverse section circular, oval or more or less triangular; siphuncle cylindrical, or dilated between the chambers, varying in position from the centre to the outer margin; surface smooth, or longitudinally, or transversely lined.

KEY TO SPECIES.

Septa distant; siphuncle eccentric. *O. amplicameratum*, 1.

Septa approximate; siphuncle varying in position. *O. dyeri*, 2.

Siphuncle central; surface smooth. *O. mohri*, 3.

Surface finely striated transversely. *O. junceum*, 4.

Siphuncle eccentric; surface with transverse lines. *O. transversum*, 5.

Siphuncle lateral; surface with obscure, longitudinal ridges. *O. ortoni*, 6.

Surface with profoundly wrinkled longitudinal lines. *O. anellum*, 7.

Siphuncle sub-central; septa annulated, concave. *O. annulatum*, 8.

Surface with low, rounded, longitudinal ridges. *O. turbidum*, 9.

Siphuncle cylindrical; shell semi-cylindrical. *O. hindei*, 10.

Edges of septa raised; narrow, raised, longitudinal line along one side of shell. *O. duseri*, 11.

Shell surrounded by two tubes; outer tubes without septa. *O. carleyi*, 12.

Siphuncle expanded into bladder-like rings at septa; surface marked by undulated, thread-like, longitudinal lines. *O. tenuifilum*, 13.

1. O. AMPLICAMERATUM, Hall. 1847.

(Pal. N. Y. I, 205. Pl. 51, figs. 1 *a–g*.)

Teretely cylindrical, extremely elongated, very gradually tapering; *septa* very convex, *distant; siphuncle eccentric*, small; section circular; surface unknown.

Locality: Cincinnati, Lebanon, O.

The septa in this species are quite large and distant. It is easily recognized by this character and by the very gradual tapering.

2. O. DYERI, S. A. Miller. 1875.

Cin. Quar. Jour. Sci., II, 125, fig. 11. Jour. Cin. Soc. Nat. Hist., III, 236, Pl. 7, fig. 7.

O. meeki, S. A. M., Cin. Quar. Jour. Sci., II, 126, fig. 12.

O. byrnesi, S. A. M., Ibid., II, 126, fig. 13. J. C. S. N. H., IV, 319, Pl. 8, fig. 8.

O. fosteri, S. A. M., Cin. Quar. Jour. Sci., II, 127. J. C. S. N. H., IV, 319, Pl. 8, figs. 7, 7*a*.

O. cincinnatiense, S. A. M., Cin. Quar. Jour. Sci., II, 127. J. C. S. N. H., IV, 319, Pl. 8, figs. 5, 5*a*.

O. halli, S. A. M., Cin. Quar. Jour. Sci., II, 128, fig. 14.

O. harperi, S. A. M., Ibid., II, 128. J. C. S. N. H., IV, 319, Pl. 8, figs. 6, 6*a*.

Shell medium size or large, gradually tapering; septa arched, distant from one-fifth to two-ninths the diameter of the shell; *siphuncle subcentral or eccentric, varying in position* and in size; outer shell unknown.

Locality: Cincinnati and Warren and Clinton Counties, O.

The numerous synonyms under this species show its variability. The supposed species differ in what may be considered individual variations, or those produced by age. It is impossible to distinguish them by either the descriptions or the figures, they are all so much alike. It has been claimed that the *O. fosteri* is the same as *O. duseri*, but no mention is made in the description of the former of the most characteristic feature of the latter, viz., the interrupted line along one side of the shell.

3. O. MOHRI, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, 124. fig. 10.)

Shell elongated, tapering regularly, .16 of an inch to an inch; septa rather strongly arched, distant one-fourth the diameter of the shell; *siphuncle central*, with appearance of a connected series of oval beads; greatest diameter of siphuncle about one-fourth the diameter of the shell. Outer chamber one-fourth the length of shell; *surface smooth, septa not being shown.*

Locality: Versailles, Indiana.

The species is best recognized by the smooth surface. It does not seem to have been found immediately about Cincinnati.

4. O. JUNCEUM, Hall. 1847.

(Pal. N. Y. I, 204, Pl. 47, figs. 3 *a–f*.)

Slender, terete, cylindrical, gradually tapering; septa thin; *siphuncle* small, *central;* section circular; *surface finely striated transversely.*

Locality: Cincinnati, Lebanon, Ohio.

Distinguished by the centrally situated siphuncle in connection with the transverse striæ. First described from the Trenton at Watertown, N. Y., but since found in the vicinity of Cincinnati.

5. O. TRANSVERSUM, S. A. M. 1875.

(Cin. Quar. Jour. Sci. II, 129, fig. 15.)

Shell medium size; septa arched, distant one-fourth or one-fifth the diameter of the shell; *siphuncle eccentric; outer shell thin, marked by transverse lines.*

Locality: Columbia Avenue and Eden Park, Cincinnati. 150 to 200 feet above low water.

Somewhat similar to the preceding, but with an eccentric siphuncle. The shell is also larger and the septa more distant.

6. O. ORTONI, Meek. 1872.

Meek. Pro. Phil. Acad. Nat. Sci., 1872, p. 330.
Meek. Ohio Geol. Pal., I, 155, Pl. 13, fig. 8.
Miller. Cin. Quar. Jour. Sci., II, 130.

Shell rather rapidly expanding; section oval or circular; septa close; *siphuncle lateral, but not marginal; surface* of cast *with traces of regular, obscure, longitudinal ridges;* outer shell unknown.

Locality: Cincinnati.

The traces of longitudinal ridges found in this and two of the succeeding species serve to distinguish them from the rest of the species. The rapidly expanding shell and the lateral siphuncle serve to distinguish this species. The figure given in the Ohio Survey is incorrect, as it represents the septa as being separated by elevated lines, which is not the case.

7. O. ANELLUM (ANNELLUS), Conrad. 1845.

Pro. Acad. Nat. Sci. Philadelphia, I, 334.
Hall. Pal. of N. Y. I, p. 202, Pl. 43, figs. 6*a* to *f*.

"Elongated, tapering, with *very prominent,* not approximate, acute, *slightly sinuous transverse ribs,* with very fine, crowded, *profoundly wrinkled longitudinal lines*; siphuncle sub-marginal."

Locality: Versailles, Ind.

Distinguished by the prominent transverse ribs. First described from the Trenton of Wisconsin, but it has been found in this group by Mr. C. L. Faber.

8. O. ANNULATUM, Sowerby. 1818.

Mineral Conchology. Tab. 133.

Hall, Pal. of N. Y. II, p. 96, Pl. 29, fig. 3.

Hall, 18th Regents report. Printed in 20th Report Regents N. Y. p. 351, Pl. 20, figs 4, 5, 6.

Hall & Whitfield, Pal. of Ohio II, p. 147, Pl. 9, fig. 1.

White, C. A. Eleventh Rept. State Geol. Ind., (1881), p. 358, Pl. 38, fig. 1.

O. undulatum, Hisinger. (Hall.) Pal. N. Y. II, p. 293. Pl. 64, figs. 1*a* to *f*, and Pl. 65, fig. 3.

Shell cylindrical, very gradually tapering: *strongly annulated:* annulations sharply elevated, rounded on top, with deep, concave depressions between them; *septa deeply concave;* siphuncle sub-central; surface of shell with concentric lines of growth, and more or less distinct longitudinal ridges.

Locality: Versailles, Ind., Westboro, Ohio.

This species is easily recognized by the strong annulations and concave septa. The longitudinal ridges are often obscure. It has been found in the Niagara and Clinton Groups of New York, Ohio and Indiana, and is identical with English and Swedish specimens.

9. O. TURBIDUM, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 100, Pl. 3, fig. 1.

Shell moderate size, gradually tapering; septa not close, slightly concave; siphuncle unknown; *surface marked by low, rounded, longitudinal ridges*, four or five in space of one-half inch.

Locality: Cincinnati.

The distant septa serve chiefly to characterize this species, and taken in connection with the longitudinal lines will serve to distinguish it. The figure shows the septa to be irregular, as if weatherworn.

10. O. HINDEI, James. 1878.

(Palæontologist. p. 1.)

(Pl. 4, figs. 4 *a to d.*)

Shell small, *semi-cylindrical*, gradually tapering, sometimes to a point; septa arched, oblique, three-quarters of a line to a line wide; section semi-cylindrical; *siphuncle cylindrical:* Length one-half to three inches.

Locality: Cincinnati.

This species is remarkable in being semi-cylindrical; in all the specimens the under side seems to be wanting, so that the section is a half circle instead of a whole one as in the rest of the species. Some of the

specimens are attached to the rock so that the one side can hardly be considered as worn away; others are entirely free and show a remarkable internal structure.

11. O. DUSERI, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 97. Pl. 3, figs. 2, 3, 4.

Shell medium size, rapidly enlarging; section circular; septa concave, gradually enlarging; siphuncle eccentric, nearer centre than margin; *surface apparently smooth; edges of septa raised above the general level in form of rings*; on well preserved specimens, the surface is covered with a network of rhombic figures, visible only under the microscope; *along one side of the shell, is a narrow, raised, longitudial line*, extending the entire length, but slightly interrupted above each of the rings.

Locality: Waynesville, Ohio.

Very well marked by the raised line along the side, interrupted by the septa. The edges of the septa are also raised above the general surface. Only very well preserved specimens show the network on the surface.

12. O. CARLEYI, Hall & Whitfield. 1875.

Ohio Geol.: Pal. II, 98, Pl. 4, fig. 19.

Shell with an inner septate tube, gradually tapering; *surrounded by two other tubes*, one-eighth inch apart; septa of inner tube closely arranged; *outer tubes without septa;* siphuncle unknown.

Locality: Fayetteville, Brown county, Ohio; Covington, Kentucky; Lebanon, Ohio.

A most peculiar species. The type specimen is now in the collection of this society. The authors of the species say of it: "The specimen lies imbeded in the rock, and weathered away to near the centre of its diameter, but the section at the end shows that the inner tubes rest upon, or nearly upon, the inner surfaces of the surrounding ones." p. 99.

13. O. TENUIFILUM, Hall.

Ormoceras tenuifilum, Hall, 1847, Pal. of N. Y. I, p. 55, Pl. 15, figs. 1 *a*, *b*, *c*: 16 figs. 1 *a* to *e*: 17 figs. 1 *a*, *b*.

Elongated, sub-cylindrical, gradually tapering to an elongated conical form; *siphuncle*, ventral, annulated, or *expanded into bladder-like rings* at the junction of septa; septa moderately concave; surface marked by longitudinal, undulated, fine thread-like lines.

Locality: Cincinnati.

This species has been placed in *Ormoceras* and in *Actinoceras*. It does not seem to differ enough to exclude it from *Orthoceras*. Its chief

feature is the bladder-like expansion of the siphuncle. It was described originally from the Trenton of New York. It has been found at Nashville and occasionally here.

Genus 2. COLPOCERAS, Hall. 1850.

Third Annual Report, Reg. Univ. of N. Y. p. 181.

"Cylindrical or sub-cylindrical, septa oblique to the axis of the shell, regularly arched on the dorsal side, and bending downward in a deep sinus towards the mouth on the ventral side."

1. C. ARCUATUM, n. sp.

Arcuata from Lat. *Arcuatus*, arched, from the arched septa.

(Plate IV, figs. 1 *a* 1 *b*.)

Shell medium size, moderately tapering; *septa wide*, ¾ to ½ inch, with a slightly elevated suture between each; strongly and *regularly arched upward* on dorsal side, and as strongly and *regularly curved downward* on the ventral, so that from two aspects the septa have an oblique direction; there is no acute angle to the septa as described in *C. clarkana*, Weth., nor a deep sinus as noted in *C. virgatum*, Hall; surface irregular, often encrusted with fragments of crinoid stems or some species of coral; siphuncle apparently none, as the whole interior of the shell seems to be filled with a finely comminuted mass of fossil particles.

Locality: Cincinnati.

The type is in the collection of this society. Mr. U. P. James has specimens of the same species.

This species differs from both those heretofore described in having the septa regularly curved and arched. The type specimen, 6½ inches long, has fifteen chambers and is compressed at the larger end. Its diameter at the small end is about ¾ of an inch and at the larger 1¼ inches. A well marked ridge runs along one side, which *may* have been caused by compression. Another specimen, however, has a similar ridge, is five inches long and has twelve chambers. It is also compressed at the larger end.

Genus 3. ENDOCERAS, Hall. 1847.

Pal. of N. Y. I, pp. 58 and 207.

Siphuncle large, lateral or eccentric, marked or ridged on the outer surface by the septa, which from their oblique direction give it the appearance of a tube with spiral lines; siphuncle enclosing from one to five elongated conical tubes.

KEY TO SPECIES.

Surface marked by transverse striæ.	*E. proteiforme*,	1.
Septa concave.	*E. annulatum*,	2.
Siphuncle very large.	*E. magniventrum*,	3.
Siphuncle marginal, obliquely annulated.	*E. approximatum*,	4.
Siphuncle sub-central, with elevations at the septa.	*E. sub-centrale*,	5.

1. E. PROTEIFORME, Hall. 1847.

(Pal. N. Y., I, p. 208. Plates 45 to 50 and 53.)

General form cylindrico-conical, more or less elongated, often compressed, tapering unequally; young specimens terminating in an acute point; *surface marked by distinct transverse striæ*, usually like narrow, sub-imbricating bands, one edge well defined and more elevated than the other, more or less distinctly striated longitudinally; striæ varying from extreme tenuity to distinct, elevated thread-like lines; section circular; septa distant one-fifth to one-fourth of the diameter of shell; *siphuncle eccentric* or sub-marginal.

Locality: Cincinnati.

This species is well named, for the forms are endless. As none of them seem to be well defined, however, all running together, none of the supposed and described varieties are here considered separately.

2. E. ANNULATUM, Hall. 1847.

(Pal. N. Y., I, p. 207. Pl. 44, figs. 1 *a b*.)

Cylindrical, gradually tapering toward apex; annulations broad, rounded, equal to depressed interspaces, distant one-fifth diameter of the tube and slightly arched; *septa deeply concave*, bending more abruptly backward just before reaching the siphuncle, and more approximate than the annulations; *siphuncle* large, *sub-dorsal*, with smooth embryo tube; section circular; surface markings unknown.

Locality:

Chiefly recognized by the deeply concave septa, a character not found in any other of our species.

3. E. MAGNIVENTRUM, Hall. 1847.

(Pal. N. Y., I, p. 218. Pl. 53, figs. 1 *a* to *e*.)

Elongated, very gradually tapering; *siphuncle very large, occupying three-fifths of diameter* of the shell; septa very convex; distant one-eighth the diameter of the shell.

Locality: Cincinnati.

This species attains a very large size and is often flattened by compression. The large siphuncle and the large shell are the distinguishing features.

4. E. APPROXIMATUM, Hall. 1847.

(Pal. N. Y., I, p. 219. Pl. 54, fig. 2 *a*.)

Cylindrical, gradually tapering; septa with convexity about one-fourth the diameter and distant one-fifth the diameter of the shell; *siphuncle* large, *marginal, obliquely annulated by the thin edges of the septa.*

Locality:

The obliquely annulated, large siphuncle is the principle feature of this species.

5. E. SUB-CENTRALE, Hall. 1847.

(Pal. N. Y., I, p. 59. Pl. 17, fig. 4.)

Elongated; septa rather distant; *siphuncle* large, *sub-central, with external imbricating elevations at the attachments of the septa*; septa near siphuncle turn upwards toward apex.

Locality:

Genus 4. GOMPHOCERAS, Sowerby. 1839.

Murch. Silur. Syst. III, p. 620. *Phragmoceras.* Brod. 1839.

Shell fusiform, or bottle-shaped, sometimes compressed, straight or curved, swollen anterior; aperture contracted in the middle; last chamber large; siphuncle dorsal or sub-central; septa simple, concave. (Tryon. Struc., and Sys. Con. II, pp. 54, 55.)

1. G. EOS, Hall & Whitfield. 1875.

Pal. of Ohio, II, p. 100, Pl. 3, fig. 5.

Shell *ovoid*, tapering from below upward to middle of outer chamber and contracting above; outer chamber about one-third entire length of *shell*, the whole *of an elongate ovate form; septa* deeply *concave*, about one-fifth inch distant. Siphuncle, surface, and aperture, unknown.

Length 4½ inches, breadth of flattened specimen 3¼ inches.

Locality: Dayton and Waynesville, Ohio, and Weisburg, Indiana.

Distinguished by its size, the ovoid form and the concave septa.

2. G. FABERI, S. A. Miller. 1884.

(J. C. S. N. H. VII, 19, Pl. 4, figs. 2, 2 *a*.)

G. cincinnatiense, S. A. M. Ibid, p. 19, Pl. 4, figs. 1, 1 *a*.

Shell *small*, moderately *gibbous;* ventral side convex; dorsal convex or straight; transverse section ovoid or elliptical; siphuncle of medium

size, and close to ventral margin; *septa slightly convex* and curving forward over the contracted ventral side; chamber of habitation of medium size, rapidly contracting toward anterior end. Shell from ½ to ¾ inch long, and $\frac{6}{10}$ to $\frac{8}{10}$ inch in diameter.

Locality: Cincinnati, from middle to top of rocks.

The small size, and gibbous character of the shell, as well as the convexity of the septa will serve to separate this species from the preceding. There is too slight a difference between *G. faberi* and *G. cincinnatiense* to make two species.

Genus 5. CYRTOCERAS, Goldf. 1832.

De la Beche Handbuch der Geognosie.
Miller 1875, Cin. Quar. Jour. Sci., II, p. 131.

Shell curved or partly involute, sometimes with longitudinal, sometimes with transverse diameter the greater; aperture contracted or not; siphuncle varying from convex to concave side.

KEY TO SPECIES.

Shell curved and tapering rapidly; septa narrow.
C. vallindighami, 1.
Septa wide. *C. faberi*, 2.
Shell ventricose. *C. ventricosum*, 3.
Shell gently curved; section elliptical; septa irregular.
C. irregulare, 4.
Section sub-elliptical; chambers thin, septa concave.
C. magister, 5.
Section slightly elliptical; chambers thin near the body chamber. *C. amoenum*, 6.

1. C. VALLANDIGHAMI, S. A. Miller. 1874.

Cin. Quar. Jour. Sci., I, p. 232, fig. 23.
C. conoidale, Wetherby, 1881. Jour. Cin. Soc. Nat. Hist., IV, p. 78, Pl. 2, figs. 6, 6 *a*.

Shell curved and rapidly tapering; septa short, nearly equal; section nearly circular; surface smooth; siphuncle small, dorsal. Length about one inch—17 to 20 septa—diameter at the ends .50 inch and .33 inch.

Localities: Cincinnati; Columbia, Tenn.; Garrard Co., Ky.; Westboro, Ohio.

Readily recognized by the small size, curved and rapidly tapering shell. There is not sufficient difference in *C. conoidale* to make another species.

2. C. FABERI, n. sp.

(Plate IV. Figs. 3 *a* 3 *b*.)

Shell strongly curved and gradually tapering: septa wide, ten in the space of two inches, measuring on the outer curve; section elliptical, with the the lateral diameter the greater; siphuncle small, dorsal; body chamber and surface unknown. Length on outer curve of ten septa, two inches; on inner curve, one inch.

Locality: Waynesville, Ohio; upper part of group.

This species differs from all the others heretofore described from this group in the great width of the septa in connection with the rapid curvature of the shell. From *C. vallandighami* it is separated by the gradual tapering and the wide septa.

3. C. VENTRICOSUM, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, p. 131, fig. 16.)

Shell ventricose, gently curved and rapidly enlarging toward the aperture; section circular, or nearly so; septa slightly concave, curving forward on dorsal side; *siphuncle* nearly marginal on dorsal side, *abruptly expanded within the chambers*. Diameter of the ends in a specimen 2.30 inches long, .44 and 1.20 inches.

Locality: Columbia Avenue, Cincinnati, 150 feet above low water.

The ventricose shell, larger size and abruptly expanding siphuncle in the chambers, will distinguish this species from the preceding ones.

4. C. IRREGULARE, Wetherby. 1881.

(Jour. Cin. Soc. Nat. Hist., IV, p. 79. Pl. 2, fig. 3.)

Shell moderately curved; septa nearly equal in anterior third, shorter and smaller in posterior third of length; *section elliptical;* siphuncle comparatively large, and dorsal.

Localities: Freeport and Waynesville, Warren Co., Ohio, and Versailles, Indiana; upper part of group.

The irregularity in size of the septa, and the elliptical section are the main features which distinguish this species from the others.

5. C. MAGISTER, S. A. Miller. 1875.

(Cin. Quar. Jour. Sci., II, p. 284.)

C. obscurum, S. A. M. Ibid, II, p. 132, fig. 17.

Shell moderately curved, enlarging toward aperture; section subelliptical, with transverse diameter the greater; septa slightly concave: *chambers thin;* siphuncle dorsal. Length of fifteen septa, 3.40 inches, on

dorsal, 2.18 inches on ventral side. Transverse diameter at the ends 2.90 inches and 2.54 inches.

Locality: 1st ward, Cincinnati, 130 feet above low water.

5. C. AMŒNUM, S. A. Miller. 1878.

(J. C. S. N. H., I, 105. Pl. 3, fig. 8.

Shell two to three inches long, gently arched and gradually tapering; *section slightly elliptical; body chamber* slightly contracted toward front, *followed by five or six thin chambers;* septa moderately arched; siphuncle small, close to dorsal margin.

Localities: Richmond, Indiana; Cincinnati.

The two preceeding species are too closely allied, and it seems likely they may be the same. The differences are so slight that they are easily accounted for by the difference in locality, the first having been found here and the second coming from Richmond.

Genus 6. LITUITES, Breynius. 1732.

(Tryon, 1883, Struct. and Syst. Concho., II, p. 56.)

Trocholites, Conrad, 1838. Sec. Ann. Rep. Geol. Sur. N. Y., p. 118. *Emended* Jour. Phil. Acad. Nat. Sci., VIII, p. 274.

"Shell planorbiform, the whorls close or separate; the last chamber produced in a straight, or outwardly curved line; lateral margins of the aperture extended and curved toward the interior of the shell, contracting the aperture into two distinct orifices." (Tryon.) "Siphuncle central or sub-central." (Woodward, Man. Mol., 1880, p. 189.)

1. L. PLANORBIFORMIS, Conrad.

Trocholites planorbiformis, Conrad. 1842. Jour. Phil. Acad. Nat. Sci., VIII, p. 274. Pl. 17, fig. 2.

Trocholites planorbiformis, Con. Hall. Pal. of N. Y., I, 310. Pl. 84, figs. 3 *a to f*.

"*Volutions higher than wide, longitudinally striated*, and with *oblique, obtuse, transverse lines*, approaching at an angle, but rounded on the centre of the back; apex profoundly depressed; back of large volution flattened; aperture much longer than wide."

Locality.—(Type) "Grimsby, upper Canada."

A specimen of what appears to be this species, is represented in the cabinet of this Society by a plaster cast. The label attached bears the name of "*Trocholites cincinnatiensis*, Clark." No such species has ever been described. It is, from the name, from this locality.

2. L. CIRCULARIS, Miller and Dyer.

Trocholites circularis, M. and D., 1878. Contri. to Pal. No. 2, p. 9. Pl. 3, fig. 10.

T. minusculus, M. and D. Ibid, Pl. 3, fig. 11.

Shell planorbiform; volutions three to five, gradually enlarging to aperture, and deeply embracing; *section sub-circular or sub-elliptical;* septa straight or directed backward, arched; apex profoundly and equally depressed on each side, perhaps perforated; body chamber long, constituting more than half the last volution; *aperture deeply notched on outer side;* surface markings unknown.

Localities: Morrow, Ohio, and Cincinnati.

The differences between these two species (*L. circularis and L. minusculus*,) are insufficient for two species, and no more than individual variations or those produced by difference in locality. One was described from Cincinnati and one from Morrow, Ohio.

3. L. BAERI, Meek and Worthen.

Trochoceras (?) *baeri*, M. and W., 1865. Pro .Phil. Acad. Nat. Sci. for 1865, p. 263.

Trochoceras (?) *baeri*, Meek, 1873. Pal. of Ohio, I, p. 157, Pl. 13, fig. 9.

Trochoceras baeri. Miller, Cin. Qua. Jour. Sci., II, p. 134.

Shell sub-discoidal, with two or three rather rapidly enlarging whorls, more broadly rounded on the outer surface than the side, and one-fourth wider than high; each inner whorl impressing inner side of succeeding; umbilicus a little more than one-half dorso-ventral diameter of outer volution and showing all inner volutions; *spire apparently scarcely rising above upper surface* of last turn; *septa* concave on side facing aperture; separated on outer side of whorls by spaces, all *showing* very *slight backward curve* on periphery and passing nearly straight across each side; surface, siphuncle and non-septate, unknown.

Locality: Richmond, Indiana; upper part of the group.

Meek and Worthen in the original description refer this species to *Trochoceras* with a mark of doubt, and say that it may belong to *Lituites*. Meek in Ohio Palæontology—vol. I, p. 157—again says: "The specimen from which this description was drawn up was defective on one side, so that it is not easy to determine whether or not its whorls are coiled in exactly the same plane, though they have the appearance of being somewhat oblique, and hence it was placed provisionally in the genus *Trochoceras*. Should it be found, however, when better specimens came to be

examined, that its whorls are coiled and in the same place [plane ?] it would belong either to the genus *Lituites*, or to some other section of the genus *Nautilus*, as the latter group is understood in its less restricted sense, and of course have to take the name *Lituites Baeri* or *Nautilus Baeri*." The former of these two names is the one here given it.

4. L. AMMONIUS, Conrad.

Trocholites ammonius, Con. 1838. Sec. Ann. Rept. Geol. Sur. of N. Y., p. 119. Hall. Pal. N. Y., I, pp. 192 and 309. Pl. 40 A, figs. 4 *a to k.*, and Pl. 84, fig 2 *a b c.*

Shell discoidal; volutions rounded, slightly concave on ventral side, gradually enlarging towards aperture; *septa direct*, or *undulated* on dorsal side; *surface* with *more or less distinct irregular transverse striæ* or ridges; outer chamber large; siphuncle central.

Locality: Cincinnati.

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1732. Breynius, J. P. H. De melonibus petrefactis montis Carmel vulgo creditis et de polythalamiis nova testaceorum classe.

Containing descriptions of the genera, *Nautilus*, *Lituites*, and *Orthoceras*.

1818. Sowerby, J. Mineral Conchology.

Description of *Orthoceras annulatum*. Tab. 133.

1832. Goldfuss. De la Beche, Handbuck der Geognosie, nach der 2, Auflage des Engl. Originals bearbeitet von H. v. Dechen (die Petrefakten-Verzeihnisse darin von Goldfuss).

Description of *Cyrtoceras*.

1838. Conrad, T. A. Second Annual Report of the Geological Survey of New York.

Description of genus *Trocholites* and species *T. ammonius*, page 119.

1838. Stokes, Charles. Transactions of Geological Society of London. Second series, Vol. V.

Description of *Ormoceras*.

1839. Brodie, P. B. In Murchison's Silurian System, Vol II, page 621.

Description of *Phragmoceras*.

1839. Sowerby, J. Murchison's Silurian System, Vol. III.

Description of *Gomphoceras*. Page 620.

1842. Conrad, T. A. Journal of the Philadelphia Academy of Natural Sciences, Vol. VIII.

Description of *Trocholites planorbiformis*, (page 274), (see under *Lituites*,) and re-description ot genus *Trocholites*.

1843. Conrad, T. A. Proceedings of Philadelphia Academy of Natural Sciences, Vol. I.

Description of *Orthoceras annellus*, (page 334).

1847. Hall, James. Palæontology of New York, Vol. I.

Contains descriptions of genus *Endoceras* (pp. 58 and 207), and species: *E. proteiforme* (page 208), *annulatum* (page 207), *magniventrum* (page 218), *sub-centrale* (page 59), and *approximatum* (page 219). Also, *Orthoceras amplicameratum* (page 205), *O. junceum* (page 204), *O. anellum* (page 202), and *O. tenuifilium* (page 55), as *Ormoceras tenuifilium*; also, *Lituites* (*Trocholites*) *ammonious* (pp. 192 and 309).

1850. Hall, James. Third Annual Report of the Regents of the University of New York. 1850.

Contains generic description of *Colpoceras*, page 181.

1852. Hall, James. Palæontology of New York, Vol. II.

Description of *Orthoceras annulatum* (p. 96), and as *O. undulatum* (p. 293).

1865. Meek, F. B. and Worthen, A. H. Proceedings of Philadelphia Academy of Natural Sciences for 1865.

Description of *Trochoceras* (?) *baeri*, (page 263), (see under *Lituites*.)

1867. Hall, James. 20th Report of the Regents of the University of the State of New York on the condition of the State Cabinet of Natural History.

Description and figures of *Orthoceras annulatum*.

1872. Meek, F. B. Proceedings of Philadelphia Academy of Natural Science.

Description of *Orthoceras ortoni*, (page 330.)

1873. Meek, F. B. Geological Survey of Ohio. Palæontology, Vol. I.

Descriptions and figures of *Orthoceras Ortoni* (page 155), and *Trochoceras* (?) *baeri* (page 157), (see under *Lituites*).

1874. Miller, S. A. Cincinnati Quarterly Journal of Science. Vol. I.

Description of *Cyrtoceras vallandighami*, (page 232).

1875. Hall, James, and Whitfield, R. P. Geological Survey of Ohio. Palæontology, Vol. II.

Description and figure of *Orthoceras turbidum* (page 100), *O. duseri* (page 97), *O. annulatum* (page 147), and *O. carleyi* (page 98). *Gomphoceras eos* (page 100.)

1875. Miller, S. A. Class *Cephalopoda* (Cuvier) as represented in the Cincinnati Group. Cincinnati Quarterly Journal of Science, volume II, pages 121 to 134, and page 284.

A review of the class and descriptions of nine new and one old species of *Orthoceras*, two new species of *Cyrtoceras*, two species of *Endoceras* and one *Trochoceras*. This partly covers the ground of the present paper and seems to be the first attempt toward the collection of the descriptions of the genera and species of the class. There are figures in outline of most of the new species.

1878. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. I.

Description of *Cyrtoceras amœnum*, (page 105).

1878. James, U. P. Palæontologist. No. 1.
Description of *Orthoceras hindei*, (page 1).

1878. Miller, S. A., and Dyer, C. B. Contributions to Palæontology. No. 2.

Descriptions of *Trocholites circularis* and *T. minusculus* (pages 10 and 11), (see under *Lituites*.)

1879. Hall, James. Cephalopoda of Up. Helderberg, Hamilton, Portage and Chemung groups. Palæontology of New York, vol. V, part 1, pages 217 to 480.

This account opens with an historical sketch of the genus *Orthoceras*, in the course of which mention is made of the American species of the genus described since 1823, comprising a full bibliography of the subject. This is followed by some remarks on the genus and its allies, and by descriptions of twenty-one old species, forty-six new ones and one new variety. The genera *Bactrites*, *Gomphoceras*, *Cyrtoceras*, *Gyroceras*, *Trochoceras*, *Nautilis* and *Goniatites* are taken up and treated in the same way. The volume of plates makes part 2 of vol. V.

1880. Woodward, S. P. A Manual of the Mollusca; London, 1880.

Definitions of genera of fossil Cephalopods are given on pages 168 to 201, with a description of the living *Nautilus*. In the appendix Ralph Tate gives fuller descriptions of some genera, and a few new ones are added in the first 12 pages. Most of the genera are represented by a figure of one species at least.

1880. Miller, S. A. Journal of the Cincinnati Society of Natural History, vol. III.

Re-descriptiom and figure of *Orthoceras Dyeri*. (page 236.)

1881. Wetherby, A. G. Journal of the Cincinnati Society of Natural History, vol. IV.

Description of *Cyrtoceras conoidale* (page 78), (see under *C. vallandighami*), and *C. irregulare* (page 79).

1881. White, C. A. In Eleventh Report of State Geologist of Indiana.
Description and figure of *Orthoceras annulatum* (page 358).

1881. Whitfield, R. P. Observations on the purposes of the embryonic sheaths of Endoceras, and their bearing on the origin of the siphon in the Orthocerata. In Bulletin No. 1 of American Museum of Natural History (Central Park, New York), page 20.

In this the writer examines the theory of the embryonic nature of the sheaths of *Endoceras*, and concludes against it. He fully describes the features presented by the duplicate siphons. Various specimens show that while the animal occupies the outer chamber, part of the body extends into the siphonal cavity in the shape of a long, loosely-hanging finger. "These sheaths were not only formed in case of accidents already having taken place, but were probably often formed to guard against future troubles." (p. 23).

1881. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. IV.

Notice and figures of *Orthoceras byrnesi*, *O. fosteri*, *O. cincinnatiense*, *O. harperi* (see 319), (see under *O. dyeri*).

1883. Tryon, Geo. W. Structural and Systematic Conchology. Phila.

In volume II on pages 13, 26, 27, 33, 45 to 48, and 50 to 87 are descriptions of the genera and sub-genera of fossil cephalopods. There are figures of many of the genera. The descriptions are short and in some cases in almost the same words as in Woodward's Manual.

1884. Miller, S. A. Journal of the Cincinnati Society of Natural History. Vol. VII.

Descriptions of *Gomphoceras faberi* and *G. cincinnatiense* (page 19).

1884. Hyatt, A. Genera of Fossil Cephalopods. In Proceedings of Boston Society Natural History. Vol. XXII. 1883. (Published Jan., 1884.) Page 253 and *et seq.*

This paper, occupying eighty-five closely printed octavo pages, is, we are told, "preliminary to a monograph which will appear in the Memoirs of the Museum of Comparative Zoology." In it the author has attempted to arrange the genera of fossil cephalopods according to a graded series, from the first straight chambered shells (*Orthoceras*) through the arcuate (*Cyrtoceras*), the loose coiled (*Gyroceras*), to the close coiled (*Nautilus*). "The generic terms Cyrtoceras, Gyroceras, Nautilus, are," he says "really only descriptive terms for the different stages in the development of an individual, and also the different stages in the development or evolution of the series of adult forms in time. In other words, each of these genera are now used to indicate representatives of all the different generic series of Tetrabranchs, which are either young shells in the corresponding stage of growth, or adult shells in the corresponding stage of evolution." (Page 254.)

By an examination of the embryos, the siphons, the sutures, and other features, the author formulates a series of orders and genera which are simply appalling. There are enumerated in this paper no less than eighty-three new genera, most of them formed on species of older genera which differ in a few characteristics from their fellows. For example, in regard to *Orthoceras*, which Professor Hall says* includes 323 species in North America, Prof. Hyatt says he "has met with but two species in North America, though doubtless others may exist, since the extreme smoothness of the shell is easily destroyed." He thinks the generic term should be restricted to "straight and comparatively smooth longicones with simple septa and sutures."† He then makes five new genera based on species of *Orthoceras* in addition to two previously made. *Gomphoceras*, *Cyrtoceras* and *Phragmoceras* each furnish several new generic names. Many of these seen to be founded on very insufficient characters, although what should be considered a good character is a matter of opinion merely. For example, *Tetramoceras* "includes Silurian species having four lateral sinuses," which were previously referred to *Phragmoceras*. *Hexameroceras*, "includes Silurian species having six lateral sinuses in their apertures," also previously placed in *Phragmoceras*. *Trimeroceras*, *Pentameroceras* have respectively, two, four and six lateral sinuses in addition to a median sinus, all these having been previously referred to *Gomphoceras*, while this last genus is restricted to the "straight and arcuate forms which have symmetrical T-shaped apertures."‡

It is an unfortunate tendency which many writers have developed to establish new names on slight differences. It is reprehensible to make new species on insufficient grounds, and still more unpardonable to establish genera. It is especially deplorable and common in palæontology, not only because of the fragmentary nature of the fossils, but because of our limited knowledge of the modes of life, the geographical distribution, and other facts which are invariably taken into consideration when living organisms are concerned.

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* Pal. of N. Y., vol. V, part 2, (text) p. 230.
† Page 275.
‡ Pages 277–78.

Dr. W. A. Dun mentioned the occurence of a fire-ball which fell between two horses, and, without injuring either, broke a stone lying on the ground.

The following were proposed for regular membership:

Dr. C. L. Boutillier, G. N. Merryweather,
Dr. W. S. Christopher, Dr. Chas. E. Caldwell,
Wm. Lytle Foster.

The gentlemen proposed for membership at the October meeting (see *ante* page 230) were duly elected.

Dr. O. D. Norton exhibited specimens of Jasper and Chrysocolla from Arizona.

Dr. Wm. Carson was elected Curator of Photography, and Mr. E. S. Comings, Curator of Meteorology.

Donations were announced as follows: From Chief Signal Officer. "Monthly Weather Review" for August, 1885; from Kentucky Geological Survey, "Geology of Clark and Montgomery, Marion, and Spencer and Nelson Counties;" from Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 32 to 34; from United States Fish Commissioner, "Bulletin of U. S. F. C.," Vol. V, Nos. 22 to 27, Plates 1 and 2; from Director of United States Geological Survey. "Annual Report for 1882–83;" from Prof. Edgar F. Smith, Specimen of Corundrum; from Fred. Braun, 42 specimens of minerals, rocks and fossils.

MEETING OF *December* 1, 1885.

PRESIDENT HARPER in the chair, and fifteen members present.

Mr. J. Ralston Skinner read a paper on "Measures of the Mound Builders." He referred to the ancient use of the Inch Measure and its connection with modern life. The ratio of 113 : 355 as the diameter to circumference of a circle, and the ratio of 6561 : 20612 were spoken of. He said that from the accuracy with which the British inch and foot fitted into the dimensions of the Great Pyramid of Egypt, that he had no doubt the builders of that work had a full knowledge of these measures. He also considered that the same monument contained measures of time and space, because of the very peculiar manner in which they were correlated. Turning to the Mound Builders of the Ohio and Mississippi valleys, he described the dimensions of the Gest Tablet and the Gridley Measuring Stone, both of which had been taken from the elliptical mound formerly standing on what is now Sixth and Mound Streets. He regarded the

latter, a semi-elliptical stone, exactly nine inches long on the straight edge, and exactly twelve inches on the curve, as the measuring stone of the ancient Mound Builders. He referred to the detailed measures of the mounds made by Squier and Davis, and showed how the works could be separated into three groups, in which the circle 1050 feet in diameter, and a square 1080 feet to the side, were connected in a peculiar manner. He quoted the opinion of Squier and Davis that the Mound Builders possessed some standard of measure, and gave as his opinion that the semi-elliptical stone was the measure in question. The paper will be published in a future number of this JOURNAL.

The following papers were read and referred to the Publishing Committee:

DESCRIPTION OF A NEW SPECIES OF GOMPHOCERAS, FROM THE TRENTON OF WISCONSIN.

BY PROF. JOSEPH F. JAMES,
Custodian Cincinnati Society of Natural History.

GOMPHOCERAS POWERSI, n. sp. Plate IV, fig. 2.

Shell medium size, oblong-oval; ventral side nearly straight, dorsal curved; body chamber contracting slightly near the aperture, and then expanding into a sort of lip, and occupying at least one-half the length of the shell: septa narrow, four or five in number: below the septa the shell contracts and tapers to where broken with no indication of septa: aperture broad oval on the ventral and contracting rapidly and rounding in on the dorsal side: siphuncle unknown. Length on straight side two inches; on curved two and one-half inches.

Locality and Formation: Beloit, Wisconsin. Trenton. Collection of C. L. Faber, Jr. The species is named in honor of Mr. H. C. Powers, of Beloit, Wisconsin.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY.

POLYPOREI. (Concluded.)

BY A. P. MORGAN.

[This paper will be printed in the next number of the JOURNAL.]

NOTES ON THE DISTRIBUTION OF TERTIARY FOSSILS IN ALABAMA AND MISSISSIPPI.

By T. H. Aldrich.

Such was the abundance of life in the Southern old Tertiary that one can hardly spend a day collecting in that region without finding new forms, and new localites for old ones, hitherto unsuspected. The different groups of the Tertiary series have many species in common, and their position must be determined from the general fauna found in each, and the actual superposition rather than from any especial forms, although they no doubt occur. Until the fauna of each division is much more thoroughly investigated than at present, it will be almost impossible to say what species are guides or "finger-posts" to the groups in question. Prof. E. W. Hilgard* states that nowhere has he been able to find *Orbitoides* associated with the bones of the Zeuglodon, or any of the characteristic fossils of his Jackson Group, and this statement is repeated by Heilprin (United States Tertiary Geology, p. 34); but in some material lately collected for me at Jackson, on Dry or Town Creek, from the beds, four and five of Prof. Hilgard's section (No. 27)† I find portions of *Orbitoides supera Con.* and *Orbitoides Mantelli Con.* associated with a few *Nummulites.* These beds immediately underlie the strata in which occur the Zeuglodon bones.

The specimens are found with the well-known "Jackson" fossils in their very "matrix," and at the typical locality for the Jackson Group. Dr. Otto Meyer‡ mentions finding an *Orbitoid* in the Claiborne Group (his bed "*b*").

We thus have evidence of the occurence of *Orbitoides* in the Claiborne, Jackson and Vicksburg Groups, giving a far larger range than was supposed, and destroying the value of *Orbitoides* as an exclusively *Oligocene* "Leit fossil" in the Tertiary of the South.

One specimen of the *Nummulite* found with the above *Orbitoid* has a strong resemblance to *N. wilcoxi*, of Heilprin, recently described from Florida.

Foraminifera are very abundant at the Vicksburg outcrop near Byram Station, Miss., associated with *Orbitoides.* A form in a siliceous limestone, from just beneath the calcareous sand bed of the Claiborne Group.

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*On the Tertiary Formations of Mississippi and Alabama, A. J. C., V. 43, p. 30. 1867.

†Ag. and Geol. of Miss., p. 131. 1860.

‡Geneal. and Age of the Species in the Southern Old Tertiary, A. J. S., Vol. 30, 1885.

has lately been received from Dr. E. A. Smith, State Geologist of Alabama. The exact location is 7½ miles east of Monroeville, Alabama.

Among the material collected at Vicksburg, Miss., is a Nautilus—sp.? which, I believe, is the first instance of this Cephalopod occuring in the *Oligocene* of this country.

Mr. Aldrich exhibited specimens of *Orbitoides* and other genera, and also a new species of crab from the Tertiary of Alabama.

The following names were proposed for regular membership:

Miss Anna M. Brown.	T. B. Collier.
John H. Warder.	Dr. B. Merrill Ricketts.
Dr. Frank Hunter.	Rev. H. D. Waller.
Joseph Nichols.	S. S. Bassler.
Warner Galway.	Dr. W. K. Boylan.

G. W. Eger.

The following were elected to regular membership:

Wm. Lytle Foster.	Dr. Chas. E. Caldwell.
Dr. W. S. Christopher.	G. N. Merryweather.

Dr. C. L. Boutillier.

Mr. E. S. Comings resigned the Curatorship of Meteorology, and Dr. W. A. Dun was elected to fill the vacancy.

Prof. Jos. F. James moved a committee be appointed to revise the Constitution and By Laws of the Society. The following was the committee as named by the Society:

Prof. Geo. W. Harper.	Prof. Jos. F. James.
Mr. J. R. Skinner.	Mr. Wm. Hubbell Fisher.

Dr. Walter A. Dun.

The Society decided to give a microscopical Exhibition in the the building on Tuesday evening, December 15th, to the members and invited guests.

Donations were announced as follows: From Smithsonian Institution, "Proceedings of United States National Museum," Vol. VIII, Nos. 35, 36, 37, 38, plates 20, 24, 25; from United States Fish Commission, "Bulletin U. S. F. C.," Vol. V, Nos. 28, 29, 30, Title and Index; from Bureau of Education, "Historical Sketch of Colleges and Universities of the United States;" from Chief Signal Officer, "Monthly Weather Review," Sept., 1885; from Dr. R. W. Shufeldt, "Description of *Hesperomys Truei*;" from Dr. Schaffranck, "Flora of Palatka, Fla.;" from Director of the United States Geological Survey, "Bulletins," Nos. 7—14; from Lieut. P. Henry Ray, "Report of the International Polar Expedition to Point Barrow, Alaska."

ADDITIONS TO THE LIBRARY FOR THE YEAR ENDING DECEMBER 31, 1885.

BY DONATION.

Agriculture, Commissioner of. Washington.
Agricultural Grasses of the United States, by Dr. Geo. Vasey.

American Entomological Society. Philadelphia. List of the Coleoptera of America north of Mexico, by Samuel Henshaw.

American Society of Microscopists. Proceedings of 7th Annual Meeting. 1884.

Beecher, C. E. Albany, N. Y. Some Abnormal and Pathologic forms of Fresh Water Shells from Albany.

Brinton, Daniel G. Philadelphia. Lineal Measures of the Semi-civilized Nations of Mexico and Central America.

Bruce, J. E. Cincinnati, O. Geological Survey of Ohio, Vol. V.

Bureau of Education. Washington. Building for children at the South.

—— —— Circular of Information, 1884, Nos. 6, 7, 1885, No. 2.

—— —— Historical Sketch of Colleges and Universities of the United States.

—— —— Planting Trees in School Grounds, and Celebration of Arbor Day.

Bureau of Ethnology. Washington. Vol. V. Contributions to North American Ethnology.

Cannon, H. M. Washington. Annual Report of Comptroller of Treasury for 1884.

Casey, Lieut. Thos. Philadelphia. Contributions to Descriptive and Systematic Coleopterology of North America, Part II. Three copies.

Census Department. Washington. Forests of North America, with Atlas, by Chas. S. Sargent. (Vol. IX of Tenth Census Reports.)

Chief Signal Officer, U. S. A. Washington. Monthly Weather Review. 1884, Nov. and Dec. 1885, Jan. to Sept., inclusive.

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Cooper, Edw. M. College Hill, O. Naturalists' Directory for Years 1878, '79, '80, '82-83.

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Annual of Boston Society of Natural History, 1868–69.

Bulletin of Cambridge Museum of Comparative Zoology, IX, No. 4.

Bulletin of U. S. Department of Agriculture, (Division of Entomology,) Nos. 3, 4.

Bulletin of U. S. National Museum, No. 3.

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THE END.

THE

JOURNAL

OF THE

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VOL. VIII.

1885–86.

PUBLISHING COMMITTEE:

JAMES W. ABERT. WALTER A. DUN.
RAPHAEL BENJAMIN. WM. HUBBELL FISHER.
JOSEPH F. JAMES.

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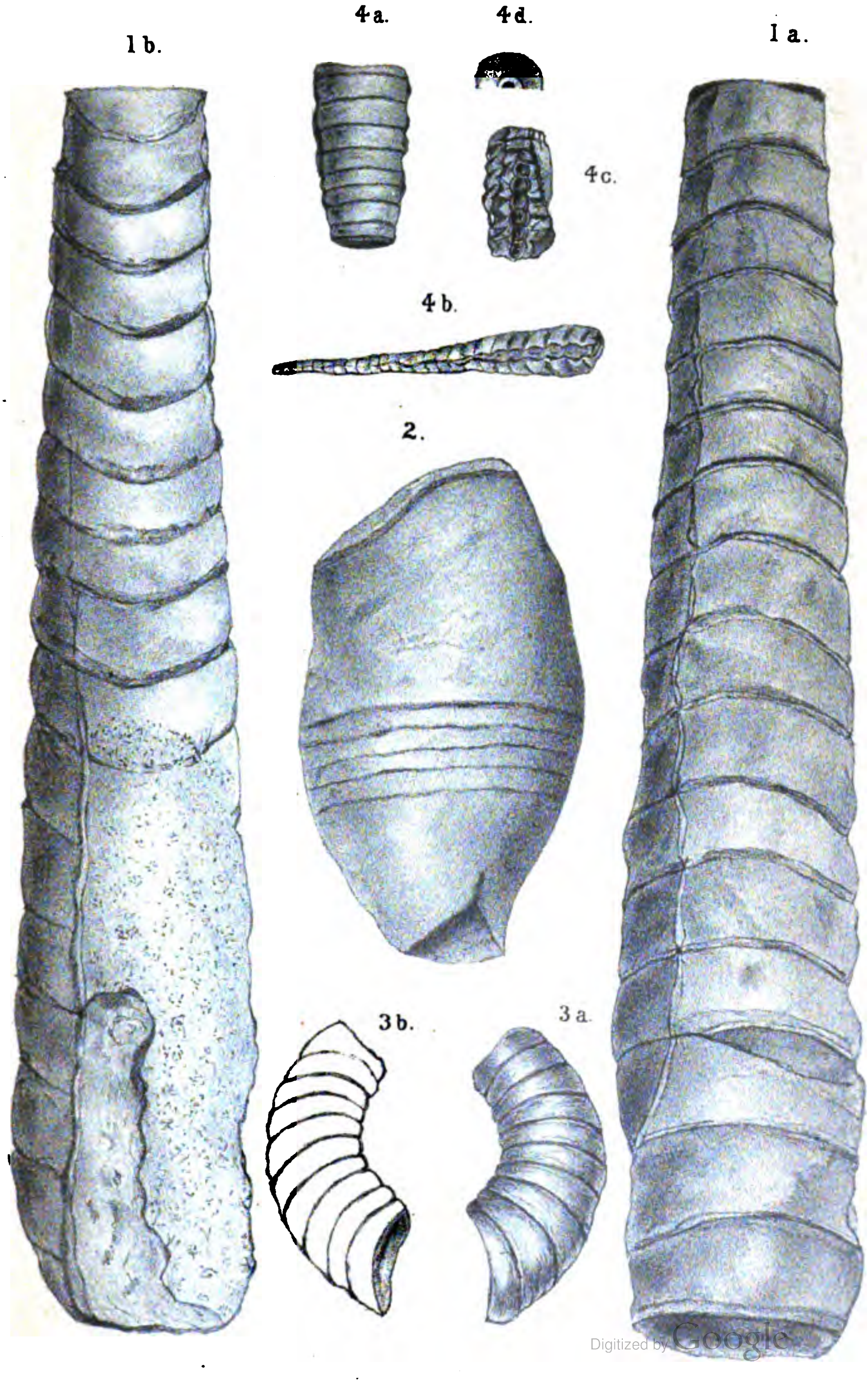
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Vol. IX. No. 2.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee:

GEO. W. HARPER. WM. HUBBELL FISHER.
TRUMAN H. ALDRICH. THOS. FRENCH, JR.
DAVIS L. JAMES.

JULY, 1886.

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Tuesday, Sept. 7.—Scientific Meeting.
Tuesday, Sept. 21.—Executive Board Meeting.

Subscription to the JOURNAL, $2.00 a year of four numbers, in advance. Single numbers, 60 cents.

The JOURNAL is devoted to the proceedings of the Society. The Publishing Committee is not responsible for opinions expressed by the authors of papers.

NOTE.—Through an oversight the paging of this number has been begun anew, instead of being made consecutive with the first number of the volume.

THE JOURNAL
OF THE
Cincinnati Society of Natural History.

VOL. IX. CINCINNATI, JUNE 1886. No. 2.

PROCEEDINGS CINCINNATI SOCIETY OF NATURAL HISTORY.

ANNUAL MEETING, *April* 6, 1886.

In absence of the President and Vice Presidents the meeting was called to order by the Secretary, and Mr. Chas. Dury elected chairman *pro tem.*

Twenty-six members present. The minutes of the previous business meeting for January were read and approved.

The following persons were proposed for membership: Alfred Gaither, H. C. Powers, Miss Mary Magurk, Miss Ellen M. Patrick, Miss Mary L. Stettinius, Lawrence Poland, Mrs. A. T Keckeler, Miss Lily Hollingshead, Dr. E. W. Walker.

Miss Emma Frick and Mr. Geo. Peck were elected active members.

The minutes of the Executive Board for December, January and February were then read.

The reports of the officers were called for and submitted as follows:

The Secretary reported that the usual monthly meetings had been held on the first Tuesday of each month, with an average of attendance for the year of 14.6.

Twenty-one papers were submitted, nearly all of which were published in the JOURNAL. Eighty members had been elected, a larger number than in any previous year of the history of the Society. The roll of members now numbers 157 names. He also submitted a list of the life members of the Society.

In the absence of the Treasurer, Mr. S. E. Wright, his report

was read by the Custodian. The receipts for the year were reported as follows:

Balance on hand April, 1885	$646 30
Income from all sources	3,262 14
Total	$3,908 44

EXPENDITURES.

General expenses, salaries, publishing JOURNAL, etc.	$2,851 15
Attorney's fees and premiums paid	186 22
Balance on hand	871 07
Total	$3,908 44

Increase of available funds $224.07. Surplus of receipts over expenditures by the Executive Board $410.99.

The number of members fully paid up (as per list submitted)	116
Members in arrears, one year	10
" " two years	9
Resigned during the year	5
Died (Dr. W. D. Clendenin)	1

The Treasurer also submitted a list of members, with the standing of each one upon his books.

Messrs. O. D. Norton, R. H. Warder and W. H. Fisher were appointed a committee to audit the report of the Treasurer.

The Curator of Palæontology, Mr. Chas. L. Faber, reported that the collection now contains about 2,000 species, 450 of which belong to the Cincinnati group. He also made suggestions looking to a better display of the collection and requested changes in the cases of the palæonlotogical room.

Mrs. M. C. Morehead, Curator of Conchology, reported a considerable addition to the department since the previous annual meeting. Several valuable exchanges had been effected, a complete catalogue of the species in the collection prepared and printed. The purchase of 400 species of Florida shells from Henry Hemphill had been ordered. Donations of money for this purchase had been made by Messrs. T. H. Aldrich, Geo. W. Harper, J. R. Skinner, Rev. Raphael Benjamin, Chas. L. Faber, U. P. James and Mrs. M. C. Morehead, amounting to $30.00, and the Executive Board had paid the additional $20.00 to make up the price of the collection. The Curator also called for more room for the display of specimens.

Mr. Geo. S. Huntington reported additions to the Department of Entomology as follows: Burrow of Carpenter Bee, Web

of Tinea Zeæ, Wood with Sclolythus burrows. The cabinet had been thoroughly inspected and disinfected. The Custodian's Catalogue of the 300 species of Calsoptera had been printed.

The Curator of Botany, Miss Nettie Fillmore, in her report said: "The first work of the year was the papering and general refitting of the room devoted to this department. The two new cabinets ordered last year were moved into their places, and in them the Custodian has arranged the Herbaniam of the Society. A card catalogue of this has been commenced. The 400 specimens of Mexican plants recently purchased are not yet fully arranged." "Among the donations are 128 species of grasses from the Department of Agriculture; seeds, section of Bamboo, fine specimen of cork, and a large lot of botanical plates and books from Prof. E. S. Wayne's collection." A section had been organized and meetings would be held regularly till June 12th. After the summer vacation the section expected to resume work in September.

The collections of the Department of Onithology and Manunalogy were reported to be in good condition by Mr. Chas. Dury. The additions during the year were fourteen birds and one mammal.

Dr. D. S. Young, Curator of Icthyology, reported no additions during the year, but the collections in good condition, though unfavorably located for observation.

Mr. R. H. Warder reported that the Department of Anthropology had received some specimens of interest. Earthenware from E. S. Wayne's collection, specimens of mound builder relics, and implements from the shores of Lake Zurich, Switzerland, from Dr. W. A. Dun. The Curator also suggested that the Executive Board consider the advisability of appropriating a few hundred dollars for the exploration of mounds.

The Report of Dr. O. D. Norton, Curator of Comparative Anatomy, showed additions to the collections by purchase from the estate of the late Dr. Geo. Bowler; skeletons of Giraffe, Horse, Lion, Leopard, Tapir, and other osteological specimens of value. The report also stated that skeletons of all the domestic animals were desired for the collection.

Dr. Walter A. Dun, Curator of Meteorology, reported that through the kindness of Serg. P. T. Jenkins, the Signal Service Observer at Cincinnati, and Gen. Hazen, the Chief Signal Service Officer, the Society now receives the "Daily Weather Map" and "Daily Weather Bulletin, 7 a. m." A large "Symbol Map" had

also been donated to the Society A section was organized under Mr. E. S. Comings, who had "felt constrained to resign." The section hoped to arrange for the distribution of forecasts and weather signals among members, and have them displayed in various parts of the city.

Mr. Geo. Bullock, on behalf of the Photographic Section, reported verbally that the section had forty-four members enrolled; that they had expended about $575.00 in fitting up the rooms assigned to them; that they met on the first and third Thursday of the month in the evening, from November to May, and in the afternoon during the summer season. The members of the Society at large were invited to attend the meetings of the section.

The Custodian and Librarian, Prof. Jas. F. James, then read his reports, as follows:

REPORT OF THE CUSTODIAN.

CINCINNATI, April 6, 1886.

Mr. President and Members of the Cincinnati Society of Natural History:

In accordance with the usual custom your Custodian begs to present his report of the work accomplished during the year just closed, and to offer such suggestions as may be of service to the Board of Officers during the coming year.

The curators of the various departments will, I presume, acquaint the Society with the additions made during the year and the conditions of the collections under their charge, so that it remains for me to acquaint the members with the means and method of providing for the numerous accessions and the general character of the proceedings during the year. The accession book, in which is entered before being put in the cases the specimens received, was alluded to in my last annual report.* This has been continued as far as practicable during the past year, and although it does not yet include all the specimens in the collection, nor even all those received in the year, yet it has now reached No. 4,800, excluding 3,000 numbered and catalogued plants, and about 1,800 numbered and catalogued shells. The same plan is expected to be continued during the coming year, and it is hoped

*See this JOURNAL, VIII., p. 76.

that this time next year all the specimens of the collections will be catalogued, and the additions constantly be posted to date.

As a part of the work of cataloguing it has fallen upon me to arrange for publication in the JOURNAL of this Society a catalogue of the whole collection. Few have an idea of the amount of work this entails, but partial results can be seen in the last volume of the JOURNAL, where in the April number is a catalogue of the Mollusca belonging to the Society, in the July number one of the Coleoptera, and in the October and January numbers one of the Library. The publication of the Mollusca and Library catalogues has been of great benefit to the Society's collection. By means of the former have been added more than 400 species of shells (received in exchange), and by the latter at least fifty volumes of valuable scientific books. Extra numbers of these catalogues were printed and can be obtained at a small price from the Librarian.

The removal of a number of flat cases, which had been left in the building on deposit, created a hiatus which has not yet been filled. The consequence was that two cases of shells and two of Indian remains had to be packed out of sight, and these are now inaccessible. I would urge upon the Executive Board of the Society the necessity of securing other cases to take the place of those claimed by the owner, in order that the collection may be adequately displayed. In this connection I will call attention to the cases of drawers, which, upon the urgent plea of the former Curator of Palæontology and the Custodian, were procured during last summer. These cases, made after a plan submitted by myself, are of stained poplar lumber, are each twenty-eight inches high, outside measure, with a base raising them above the floor, twenty-two inches in width, and the same in depth. Each case contains six drawers, each one three inches deep, inside measure, and with a lock for securing the specimens from molestation. These cases have been filled with fossils, and answer the purpose for which they were made admirably, and as they are high enough from the floor to admit of a flat glass case being put upon them, they utilize space which would be otherwise lost. I would suggest that other cases be modeled upon these, and the bulk of the fossils and shells be herein placed, having of course a sufficient number in flat cases for an attractive display.

The want of case room for specimens has become most urgent. Those devoted to minerals are already overflowing, and yet there are several hundred requiring room. I do not find that the sug-

gestions of the last Curator of Mineralogy have been acted upon during the past year, though I think the Society would have done well to see that a collection of typical rocks, minerals and petrological specimens, such as ripple marks, mud cracks, rain drop impressions, and so on, was arranged for display. This department, too, should be made of practical use. Examples of the various forms of granite, syenite and gneiss, might have enabled the paid inspectors of our coming granite pavements to perform their work with something like intelligence.

Since my last report the room devoted to Botany has been fitted up, as your Curator of Botany will inform you, and three rooms on the first floor in the rear of the building have been given up to the Photographic Section and admirably arranged, of this the Curator of Photography can inform you, as it has been done under his supervision and that of the Secretary of the Section, Mr. E. J. Carpenter.

Two valuable donations have been received during the year which deserve special mention. One of these is a collection of fifty paintings of Fungi of North America, painted by Mrs. A. P. Morgan. They are in oil, and are accurate scientifically, and beautiful artistically. They have been framed, and now decorate the walls of our building. The other donation was one of thirty-eight photographs of Western scenery received from the United States Geological Survey. These represent views in Colorado, Utah, New Mexico and the Yellowstone region, and would be ornamental if framed and hung upon our walls, as they should be.

The collections have been viewed by numbers of citizens and strangers, and have been used to a certain extent by the schools, but not so freely as in previous years, because, perhaps, the teachers have not taken the pains to come with the scholars. But on two occasions during the year there was an especially large number of visitors and guests of the Society. One of these occasions was the celebration of the birthday of Louis Agassiz on May 28th. On this occasion Dr. James A. Henshall read by invitation a eulogy on Agassiz which was afterward printed in full in the JOURNAL of the Society.* At the conclusion of the reading of this paper and of a poem by Mrs. R. Murdoch Hollingshead, the company spent a pleasant hour in examining the objects exhibited under a number of microscopes loaned by the Society members and others.

*Vol. VIII., p. 129, July, 1885.

The other occasion was on December 15th, when invitation cards were issued for a microscopical exhibition in the Society lecture room. Some seventy-eight microscopes were on the tables, and many interesting objects were shown. Among them was a living Hydra, exhibited by Mr. Geo. B. Twitchell, the circulation of blood in a frog by Dr. Walter A. Dun, section cutting by Dr. Allen, of Glendale, and many others. The company gathered together expressed themselves highly gratified, and the Society can be sure that receptions and exhibitions of this kind are of great importance in keeping it before the public, as well as enabling the citizens to know of the existence of our institution.

The feature of the past year, however, which has been most prominent in the work, has been the series of lectures given under the Society's auspices. The first course given was one on Practical Analytical Botany, for the benefit of the teachers of the public schools especially. This course began April 18th and continued every Saturday morning from 10 to 11 o'clock until June 20th. The average attendance was twenty, and as the accommodations were limited to twenty-five, it can be seen the lectures were appreciated. They were given by your Custodian, and were devoted to the explanation of the manner of analysis of between forty and fifty flowers.

The second course was also for the benefit of public school teachers, and was on Physiology and Hygiene, and given by Dr. Walter A. Dun. Some sixty-five tickets were issued to applicants, and the first few lectures were attended by from thirty to forty teachers. At the end of the course, however, enthusiasm slackened, and from twelve to fifteen was the average number. The course began on October 3rd and lasted till December 12th, ten lectures in all, one Saturday being omitted. These lectures were illustrated by blackboard sketches, experiments and microscopic specimens.

The third and last series was the regular Popular Scientific course, which has attracted much attention and become a necessary part of the winter programme of the Society. The arrangements were made for this course by the middle of December by the Lecture Committee, and on Friday, January 8th, the first one was delivered. They followed at intervals of one week and the course was concluded on the 19th of March. The following were the subjects and the lecturers:

"Hudson's Bay and Its Territory."..MR. WM. HUBBELL FISHER.
"Ants and their Habits."..............PROF. A. D. MORRILL.
"Science in Schools."...............REV. GEO. M. MAXWELL.
"Clarification of Water."... ....PROF. C. R. STUNTZ.
"Geology of Natural Gas."............PROF. EDWARD ORTON.
"Atmospheric Electricity."................MR. E. S. COMINGS.
"Our World a Type of Other Planets.".PROF. GEO. W. HARPER.
"Astronomical Review."............PROF. R. W. MCFARLAND.
"An Australian Fern-tree Forest."....REV. RAPHAEL BENJAMIN.
"Nebulæ and Star Clusters."............MR. WM. H. KNIGHT.
"Experiments in Electricity and Magnetism."
MR. GEO. F. CARD.

Such was the interest taken in these lectures that on most occasions there was standing room only to be had. The lecture room was not large enough to hold the audiences. On two occasions, viz: "The Geology of Natural Gas" and "Experiments in Electricity," there seemed to be so much interest manifested that College Hall was secured, and on both nights the hall was filled with an interested audience. The good which these evening lectures has done the Society is not to be estimated, for while no one can tell the indirect advantage, the direct good to the Society has on many occasions been plainly manifested.

The difficulty experienced in seating the audiences gathered in our own lecture room has forced upon the attention of the members a fact which has long been patent to a few, namely, the necessity for a larger room. The present room is large enough for a comfortable reading, reception and library room, but it is totally inadequate for lectures of a popular scientific nature. Were it three times as large there would be little difficulty in filling it at our evening lectures; and although the matter was spoken of at some meetings last year and nothing was done, it behooves the members of the Society and of the new Executive Board as our managers, to take immediate steps toward an enlargement of our building. We have still some unoccupied ground, and it has been estimated that at a sum not to exceed seven or eight thousand dollars an addition could be made to our present quarters which would give room for the increase of our museum, and give us a good sized lecture hall, room sufficient for several years to come. There is already in the hands of the Treasurer a nucleus for a building fund, and if some of the wealthy men of our city would give but a fraction of what has

been and is being put into the Cincinnati Museum we would be in position to make ourselves much more useful than heretofore. This is the greatest need now of the Society, and the watchword and rallying cry of members and officers should be

"A new building and more room."

All of which is respectfully submitted,

JOS. F. JAMES, Custodian.

REPORT OF THE LIBRARIAN.

CINCINNATI, April 6, 1886.

Mr. President and Members of the Cincinnati Society of Natural History:

Your Librarian takes the opportunity at this the annual meeting of the Society to acquaint the members with the condition of the library at the close of the year just passed, and he takes great pleasure in presenting a favorable report.

During the year a catalogue of the books and pamphlets in the library has been printed in the JOURNAL, occupying fifty-one pages, and showing a total number of nearly 2,800 volumes and pamphlets on the shelves. Some of the last are bound, and some await collation and arrangement into volumes. Besides the printed catalogue, the card catalogue has been kept posted up to date, so that with very littletrouble it can be ascertained whether a volume wanted is in the library or not.

The additions during the year ending December 31, 1885, were 415 volumes and pamphlets. Many of these have been received in exchange for the JOURNAL of the Society, through donations were liberal. A full list of the additions was printed in the JOURNAL for January, 1886.

The exchange list of the Society has assumed considerable proportions. There are now 114 on the list, and of these ninteen have been added since the last annual meeting. From the list appended to this report it can be seen that the JOURNAL is sent to nearly all parts of the world. Most of the societies in the country that publish proceedings are on the list, as well as many periodicals of a scientific nature. The number of subscribers is necessarily small, there being at present only nine.

There have been about 120 copies distributed to members during the past year, but owing to the increase of membership this

number will probably be greater during the year to come, as 500 copies are printed of each number, there still remain about 250 for further distribution or sale.

Besides the additions made to the library by the exchange of the JOURNAL, considerable additions have resulted from the exchange of duplicates of various books which have been received, and this will probably be a source of considerable increase in the future. Of various periodicals and pamphlets accumulated, 115 volumes have been bound and placed on the shelves. This rapid increase will soon crowd the shelves and make more room a necessity, but at present there is still space at command.

The use of the library has been limited, but it is hoped that the members of the Society will soon come to realize the value of the library as one of reference and consult its books and pamphlets more frequently.

(Then follows a list of the exchanges of the Society.)

Respectfully submitted,

JOS. F. JAMES, Librarian.

The Society then elected officers for the year as follows:

President,	Dr. Walter A. Dun.
First Vice President,	Wm. Hubbell Fisher.
Second Vice President,	J. Ralston Skinner.
Secretary,	Davis L. James.
Treasurer,	S. E. Wright.
Trustees, one year,	Julius Dexter.
two years,	Reuben H. Warder.
Librarian,	Joseph F. James.

Members at large for the Executive Board:

T. H. Kelley,	Wm. H. Knight,
Rev. Raphael Benjamin,	Dr. O. D. Norton.

Curators—

Geology,	J. W. Hall, Jr.
Entomology,	Geo. S. Huntington.
Conchology,	Mrs. M. C. Morehead.
Botany,	Miss Nettie Fillmore.
Zoology,	Chas. Dury.
Osteology,	Dr. O. D. Norton.
Anthropology,	Geo. W. Harper.
Photography,	George Bullock.

Meteorology,	L. M. Prince.
Microscopy,	Geo. B. Twitchell.
Physics and Chemistry,	Prof. Thos. French, Jr.

The Secretary was instructed to convey to Gen. W. B. Hazen and Serg Jenkins, of the Signal Service, the thanks of the Society for kind assistance in procuring for the Society the Daily Weather Bulletin and Symbol Map.

Mr. R. H. Warder moved that "a committee be appointed to take such action as may be necessary to create public sentiment against the use of skins of our song birds for millinery and ornamental purposes."

Messrs. R. H. Warder, Wm. H. Fisher and Chas. Dury were appointed a committee with power to act.

The President, Dr. Dun, (who had taken the chair) said that a committee had been appointed to report upon the granite to be used in paving the city streets, and that there would be a special meeting of the Society to receive and discuss this report at an early date.

Mr. Aldrich said that Mr. Thornton Hinkle had prepared a paper on various kinds of pavements for the Literary Club, and moved that Mr. Hinkle be invited to be present at the discussion.

Mrs. Jos. F. James, Secretary of the Botanical Section, invited all members interested in Botany to attend a meeting of the section April 10, 1886, at 2 p. m.

Dr. Dun said that the special meeting spoken of above would be held April 16th.

Adjourned.

Donations were received as follows: From J. A. Townley, cone of Pinus Lambertiana, cones of Sequoia gigantea; from Am. Ornithologist's Union, two pamphlets; from Director United States Geological Survey, Fifth Annual Report; from Chas. L. Faber, three species fossils, two cases of drawers, three flat cases, one stand; from W. A. Dun, M. D., specimens Swiss Lake dweller remains, mound-builder skull, arrow points and gorget from Ohio; from United States Fish Commission Bulletin, Nos. 1, 2 and 3; from Dr. O. D. Norton nine specimens marbles; from Signal Service Officer Monthly Weather Review, January, 1886; from J. A. Lintner, Second Annual Report New York State Entomologist; from the Bureau of Education Report of Commissioner, 1883–4; from the estate of E. S. Wayne, about 100 volumes, books,

300 botanical plates, 300 species minerals, 50 specimens fossils, a lot of unbound magazines; from Division of Entomology, Department of Agriculture, Bulletin No. 11; from Dr. O. D. Norton Eaton's Botany North America; from Robt. Ridgeway Stejneger's Explorations of Commander Islands and Kamtschatka; from James W. Queen & Co. Microscopical Bulletin No. 6; from I. C. Reeve Abbreviations in the Geological Record; from Department of Agriculture, per Geo. Vasey, 128 species American Grasses.

SPECIAL MEETING TUESDAY, *April* 16, 1886.

Dr. Dun presided, and Prof. Geo. W. Harper read a report upon "Granite used for paving in the city streets." The paper was followed by an interesting discussion, in which the invited guests of the Society took part. The proceedings of the meeting were fully reported with an exhaustive abstract of the paper in the daily papers of the next morning.

SCIENTIFIC MEETING, TUESDAY, *May* 4, 1886.

Vice President Fisher in the chair. Fifteen members present.

The minutes of the meeting for March were read and approved.

Mr. Fisher called attention to the omission of the words "of April" in Section I., Article 3, of the printed copy of the revised constitution.

Prof. Jos. F. James read a paper on the "Geology of Cincinnati."

Dr. Dun, the President, now took the chair.

Prof. Harper, the retiring President, then read his annual address.

The following persons were nominated for active membership: Miss M. Therese Davis, Miss Katharine M. Lupton, Mr. and Mrs. R. F. Leaman, Mr. Wm. Gibson, Miss Mary Osborn, M. D., Miss Ida Murdoch, Mr. Chas. Goepper.

Members were elected as follows: Miss Ellen M. Patrick, Miss Mary E. Magurk, Miss Mary Stettinius, Miss Lily Hollingshead, Mrs. A. T. Keckeler, Lawrence Poland, Alfred Gaither, H. C. Powers, Dr. E. W. Walker.

The Custodian announced that a case of minerals showing granites and their constituents had been prepared for exhibition in the Chamber of Commerce.

Mr. W. H. Fisher reported verbally on behalf of the Auditing Committee. (The report in writing was afterwards filed with the Secretary).

President Dun said that a class would be organized at an early day to study the weather under Mr. S. S. Bassler.

The Botanical Section showed a collection of native and hardy exotic plants in blossom, in all about eighty species.

Members were invited to attend a meeting of the Photographic Section on Thursday, May 6th, at 3 p. m., to examine a series of lantern slides.

Adjourned.

Donations were announced as follows: From Chief Signal Service, Weather Review, February, 1886; from Geo. J. Hinde, one pamphlet; from P. Herbert Carpenter, Review of Fossil Crinoids; from J. F. Judge, M. D., collection of shells, fossils, etc.; from A. P. Morgan, species of Polyporei of Miami Valley to illustrate articles published in the Society's JOURNAL; from Paul Mohr, sixteen (16) specimens marbles; from John H. Warder, specimen Bessemer Steel, two specimens artificial graphite.

MICROSCOPICAL EXHIBITION.

On the 30th of April a public microscopical exhibition was given at the rooms of the Society. Some twenty microscopes were exhibited by Messrs. F. Spaeth, M. A. Spencer & Co., Crocker & Co., and Dr. Marsh, as well as by members of the Society.

The objects to be seen covered almost the entire field of microscopical research. Micro organisms of disease were exhibited by Drs. Ricketts and Caldwell. Diatoms by H. C. Fithian and Dr. J. H. Hunt. Living pond life in the shape of a hydra by Dr. Hunt, and fresh-water algæ by Geo. B. Twitchell.

Dr. Taft exhibited a section of a cat's jaw, which aside from its value for study in histology, was a remarkable specimen of skillful work in preparation. The circulation of the blood in a frog's foot could be seen through Dr. Dun's microscope. Prof. James demonstrated the microscopic structure of the higher plants. In the way of accessary apparatus a new microtome exhibited by Dr. Allen, proved of great interest to all working microscopists present.

TUESDAY EVENING, *May* 25, 1886.

A special meeting was held under the direction of the Lecture Committee to receive reports of the Committee on "Destruction of Native and Song Birds." Messrs. Chas. Dury, R. H. Warder and Wm. Hubbell Fisher read papers on the subject.*

TUESDAY, *June* 1, 1886.

President Dun in the chair. Twenty members present.

The minutes of the preceding meeting for May were read and approved.

Dr. F. W. Langdon read a paper on "The Destruction of our Native Birds."

Mr. Chas. Dury exhibited a specimen of a hybrid duck—a cross between the Mallard and Pin-tail.

Mr. Dury also read several notes upon the disappearance and growing variety of wild pigeons, cormorants, quail and birds generally. He did not agree with Dr. Langdon's conclusions, and thought that the Doctor had underestimated the destruction of birds for millinery purposes. The disappearance of the wild pigeon was directly due to man and not to the scarcity of food or the destruction of forests.

Dr. Langdon said that his paper was chiefly written to protest against what seemed to him an undue exaggeration of the influence of man in destroying song birds. The growth of cities drives birds away from only small localities. That the United States will ever be without song birds is too much to say. Man is not the principal factor in nature. Species have appeared and disappeared long before he appeared upon the field of action. The work of the palcontologist shows that many have become extinct through wholly natural causes. These causes still operate, and man can change them but little, if at all. The ivory-bill wood pecker, cited by Mr. Dury, was always a rare bird. It had disappeared from our locality, but man was not directly responsible for its extinction. A law higher than man governs the destruction of species. The offer of $100,000 could not extirpate the English sparrow in the State of Ohio.

Prof. J. F. James said that the inhabitants of foreign countries were deserving of consideration as in the matter of destruction of

*Abstracts of these papers, and that of Dr. Langdon, read June 1st, will appear in another place in the JOURNAL.

bird life for ornament. The whole world is interested. The fact that tropical birds are more commonly used for ornament did not change our obligation to desist from encouraging the destruction of birds from whatsoever a source the supply of ornaments may be derived.

Mr. J. R. Skinner asked if there was any perceptible decrease in the numbers of robins, warblers and thrushes.

Mr. Dury said he thought there had been no decrease; that they had increased in numbers in some localities, as far as he had observed.

Dr. Langdon said he had heard two wood thrushes in song in Avondale but a short distance from Main avenue.

Dr. Dun said he was glad to hear from Dr. Langdon. Every question had two sides, and it is well to consider them. The mortality of man in our city is as great as that in the bird world, according to the figures given by Dr. Langdon. Fish have been saved from extinction by the fostering care of the State through its fish commission. Cannot similar work be done for the birds.

The following papers were read by title: "On the Making of Lantern Slides," by E. J. Carpenter, read originally before the Photographic Section, and now presented to the Society. "The Tertiary Fauna of Newton and Wautubbee, Miss.," by Otto Meyer and T. H. Aldrich.

Prof. J. F. James read a short paper on "Recent Synomyms in the Paleontology of the Cincinnati Group."

Messrs. H. P. Piper and Harry W. Brown were nominated for active membership. The Executive Board proposed the name of Prof. R. W. McFarland for honorary membership.

The following persons were elected for active members: Wm. Gibson, Mr. and Mrs. R. F. Leaman, Miss Mary E. Osborn, M. D., Miss Ida Murdoch, Miss Katharine M. Lupton, Mr. Chas. Goepper, Miss M. Therese Davis.

The resignation of Thos. French, Jr., Curator of Chemistry and Physics, was received and accepted.

A specimen from Idaho, said to be an "Agate plant," was referred to Mr. Geo. B. Twitchell, Curator of Microscopy, for report.

A communication addressed to the President from V. Lieutamd, offering to sell to the Society an ancient inscribed stone, was received and referred to the Executive Board.

The report of the Curator of Mineralogy was read and accepted.

By motion, duly seconded and carried, Dr. O D. Norton was made a committee of one to present the thanks of the Society to Mrs. E. W. Wayne for the generous gift to its museum of her late husband's collection of minerals and natural history specimens.

The Society then adjourned.

The donations for the month were as follows; From E. O. Ulrich, contributions to Am. Paleontology, vol. 1, May, 1886; from the Division of Entomology of the Department of Agriculture, Bulletins Nos. 8 and 11; from Yale College, Report of Observatory, 1884–85; from Chief Signal Officer, Weather Review, March, 1886; from Smithsonian Institution, Report 1884; from Carlos Shepard, skull from mound on Big Miami; from U. P. James, stem of Aralia spinosa; from Jacob S. Burnet, specimen of Belostoma grandis; from Mrs. U. P. James, larvæ of beetles; from Mrs. M. Cassily, three specimens coccoons Cecropia Moth; from John C. Branner, M. D., pamphlet on Glaciation of Wyoming and Lackawanna Valleys; from E. D. Cope, three pamphlets; from United States Geological Survey, Bulletins Nos. 24, 25 and 26; from Chas. E. A. Ryder, wasp's nest from Buenos Ayres; from Dr. O. D. Norton, accretion from sparks in sawing steel; from Zoological Garden, one Lop-eared Rabbit, one Barred Owl, one Black Howling Monkey.

ANNUAL ADDRESS

BY PROF. GEO. W. HARPER. (Read May 4, 1886.)

The large increase in the membership of the Society during the past year, the many and valuable additions to our library and museum, and the present healthy condition of our finances, are not only evidences of present prosperity, but are omens of good in the future. This flourishing condition of our Society should be a source of gratification not only to every member, but to every lover of science in our city, but we must not forget that this substantial growth brings with it increased responsibility.

Within the near future several questions must be settled, questions of great interest not only to our city but to the cause of science in general. Prominent among these questions is, the future location for this Society. Large and valuable private collections are awaiting the decision of this question. Our rooms are already over-crowded, and many valuable specimens are relegated to dark corners where they can not be seen to advantage. It is true that the present building might be enlarged so as to cover the entire lot, but the relief would be but temporary, for in a very few years we would need additional room.

It is quite plain that at an early day we will be compelled to remove from our present location, and any move is likely to be a permanent one. Hence the question, where? should be carefully considered and wisely settled.

The great cost of a suitable lot and the question of cleanliness are two insuperable objections to any location within the limits of the lower levels of our city. If, then, we must go to the hill tops, there are only two localities eligible—Burnet Woods and Eden Park. In both a site could be selected high and isolated, so as to avoid a large percentage of the dust and smoke, so detrimental to fine collections, within the heart of our city.

Between these two locations the preference should be given to Eden Park, as it will soon be very accessible, having two cable lines connecting it with the center of the city, and because there is already located there a museum of art, and this would become doubly attractive if it were a museum of science as well as of art. In other cities where the great mistake has been made of organizing separate museums of science and art, the two institutions have become rivals for public favor to the detriment of both.

The directors of the West Museum have already accepted in in trust a large and valuable collection of ancient Peruvian pottery.

The extensive collection of minerals, fossils and archeology belonging to Paul Mohr, Esq., will be displayed in the same building.

Mr. Cleneay's numismatic cabinet, together with his unrivaled collection in archeology, will no doubt take the same direction. By this action of the trustees in furnishing room in their fire-proof building for these valuable collections in science, they have already laid the foundations of a great museum of the arts and sciences, which will either overshadow or absorb all kindred institutions in our city. If the Mechanics' Institute, the State Archeological Association, the Historical Society of Ohio, the Natural History Society of this city, and all similar institutions, while maintaining their separate organizations, were to concentrate in one building, or cluster of buildings, with a common hall for assembly purposes, they would each and all better conserve the purposes for which they were founded.

Great libraries and museums permeate with their healthful influence all grades of society. They not only attract the passing stranger but they invite permanent residents among the better class of educated and refined people, and particularly special students of science, who naturally seek homes in places where the largest facilities are afforded for study.

In a great commercial and manufacturing city competing sharply with rival cities for the trade of a wide extent of territory, it becomes necessary that our citizens be thoroughly posted in regard to the great and live questions of the day, and what can conduce to this end better than these great public institutions.

Nearly all valuable discoveries and inventions were first thought out and formulated in the busy brain of some scientist and then handed over to a practical man who never could have originated them, but who is quick to discern their practical bearing and to push them in the marts of the world for all they are worth. It is only when the enthusiast in science and the practical man of the world go hand in hand that there is real substantial progress.

Our University can never become a seat of learning in the true sense without these necessary adjuncts of the higher education. Time was when our lovers of art were compelled to live in exile in order to draw inspiration from the great art collections of

Europe, while our scientists in like manner made long pilgrimages to the great museums of Paris, of Berlin, and London, but now our home collections are exciting an interest even on the other side of the ocean.

The large and unrivaled collections made in the Bad Lands of Dacotah by Prof. Marsh for the Yale College, and the remarkable work done by Louis Agassiz and his co-laborers for the Harvard College Museum are well-known.

The growth of the American Museum, established in Central Park, New York, a few years ago, has perhaps been the most remarkable. The City of New York has so far expended over half a million towards the building, which is only about one-eighth of the intended cost when completed. This museum is maintained by a private society. It has already received the following donations, namely a conchological collection, numbering 50,000 specimens, and valued at 10,000 dollars, with a library on conchology numbering 10,000 volumes, the gift of Miss Catharine Wolfe. The Maxmilian and other collections, containing 4,000 mounted specimens of mammals, birds, etc. Collection of North American birds, 2,500 specimens, lepidoptera 10,000, beetles and insects 4,000, and over 7,000 specimens of minerals. Add to these Dr. Davis' pre-historic collection, numbering many thousands of specimens, and Prof. James Hall's large collection, containing many valuable types of silurian fossils, described by him and others, which was purchased for $6,500, and presented to this same museum. The above are only a part of the many donations made to this museum since its foundation.

The Academy of Natural Sciences of Philadelphia has also grown enormously within the past few years. Among its many valuable acquisitions is the collection of Crania, numbering over 1,300 specimens, begun by the late Dr. S. G. Morton, and said to be the finest in the world.

There seems to be no good reason why the Queen City of the West should not have a great museum of the sciences as well as of the arts. The enterprise and generosity of our citizens in the past is an assurance that all the money needed to accomplish this object will be furnished as soon as our Society has proven itself competent and worthy of such a trust.

THE GEOLOGY OF CINCINNATI

By PROF. JOSEPH F. JAMES,

Custodian of Cincinnati Society Natural History.

(Read May 4, 1886.)

The City of Cincinnati occupies one of the most interesting geological positions on the North American Continent. As has been truly expressed, the hills of Cincinnati are counted as classical ground by geologists of all lands, and "Sir Chas. Lyell said, after visiting the hills and looking over the collections that had been made of their treasures, that there was no other locality known in the world where so large a number and so large a variety of well preserved Lower Silurian forms could be so easily procured."*

But beside the fossil treasures which exert so potent an influence over the minds of collectors, there are other matters of great interest connected with the ground upon which the city stands, and by which it is surrounded. Few attempts have been made to study the surface geology of the vicinity. The chapters in the Ohio Geological Survey† contain about all that has been written on the subject, so that it is by no means exhausted. To elucidate some of the problems relating to the geology and topography of Cincinnati and its vicinity is the object of the present paper.

That subject of much controversy among geologists, viz: whether the rocks as exposed in our neighborhood should be known as the Hudson River and Utica slate, or as the Cincinnati Group, will detain us but a short time. Prof. James Hall, as the leader among Eastern geologists, insists that the rocks are of the same age as the Hudson River Group, and should be so called. Dana follows him, as, in fact, do most of the Eastern geologists. But Newberry, Orton, Meek and Worthen, four geologists who have given much attention to the exposure in Southwestern Ohio, insist that the rocks are not equivalent to either the Hudson River or the Utica slate; but that there is a commingling of Trenton, Hudson River, Utica Slate, and some peculiar fossils found in none of these which entitle the exposure to a distinct name, and so they call it the Cincinnati Group. It seems well chosen and

*Ohio Geol., I., p. 385.

†Vol. I., chaps. 4, 13, 14 and vol. II., parts of chap. 30.

worthily applied; for, although rocks of the same age are found in other states and other localities in Ohio than about Cincinnati, yet it is here that they are best exposed; here where most of the work has been done, and the name of Cincinnati Group will be adopted in this paper.*

But leaving this to be discussed by others, let us proceed with the subject in hand. No matter what name may be given to the particular group, no one is prepared to deny that it belongs to that great series of sedimentary strata known as the Lower Silurian. Rocks having the same general characters, and often with the same varieties of animal life, are exposed to the east as far as Waynesville, to the north as far as Dayton, and on the west to Madison, Indiana, reappearing in places in Illinois. While to the south it extends to near Frankfort, Kentucky, reappearing at Nashville, Tennessee.

Like all other fossil-bearing rocks, those of the Cincinnati Group are sedimentary in their origin, and were originally derived from the wearing away of lands either near or remote. In the present instance, all the sediment was derived from high mountains which existed far north of Lake Erie, forming part of the ancient Archean Continent. At this time there stretched a deep sea over the earth south of the 45 deg. of north latitude, and upon the floor of this ocean the sediment from the Canadian mountains was deposited in immense sheets, aggregating more than six thousand feet, and filled with a most wonderful profusion of animal remains.

The period of time required for the deposition of this sediment was immense, and is not to be readily calculated. But the time at last came when certain elevatory forces began to act, and there was at last raised above the sea level an island, extending from somewhere near the center of western Ohio, south to the center of Kentucky, while near the same time large tracts appeared above the water in northern and eastern New York, in Wisconsin, Illinois, Minnesota, and small outlyers in Missouri, Arkansas and Tennessee.

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*It may be well to state that some years ago (See this JOURNAL, vol. I, p. 193) certain of the geologists and collectors of Cincinnati presented a report to this Society recommending that the term, "Cincinnati Group," be discarded in favor of that of "Hudson River Group." But since that time some of these gentlemen have reconsidered their action, and now recognize the term "Cincinnati" as more appropriate. It may be said that the majority of Western geologists recognize the term "Cincinnati," while the majority of Eastern geologists adhere to "Hudson River" and "Utica Slate."

The elevation of the land, in this vicinity at least, was very gradual, so much so that no distortions or flexures of any consequence were produced in the strata, and they rose above the surface in almost perfect horizontality, with the exception of a slight dip to east, west and north. In our vicinity there appears to be evidence of depression as well as elevation. At intervals both forces have acted. Well defined sea beaches are found at at least two horizons in this locality. One of these is at about low water in the Ohio river, and the other one at between 300 and 400 feet higher. The lower one of these beaches is characterized by a certain peculiarly waved structure of the rocks, and also by various mud cracks, tracks and markings which could only have been made and preserved near the margin of an ocean, or on absolutely exposed surfaces of land. Prof. Orton describes the appearance of the rock presented at low water mark on the Kentucky side of the Ohio river at Ludlow excellently, and I can testify that his description is accurate, as I have seen it many times. He says :* "The rocks exhibiting this (waved) structure are the most compact beds of the fossiliferous limestone. The bottom of the waved layer is generally even, and beneath it is always an even bed of shale. Its upper surface is diversified, as its name suggests, with ridges and furrows. The interval between the ridges varies, but in many instances it is about four feet. The greatest thickness of the ridge is six or seven inches, while the stone is reduced to one or two inches, at the bottom of the furrow, and sometimes it entirely disappears. The waved layers are overlain by shale in every instance. They are often continuous for a considerable extent, and in some cases the axes of the ridges and furrows have a uniform direction. This direction is south of east in the vicinity of Cincinnati, but in traversing the series, these axes are found to bear in various directions."

The shore line as here considered must, of course, have been formed at an earlier period than that at which the strata above were laid down. And during this deposition the former shore line must have been under water, and then it was that three or four hundred feet of rock were formed. Part of this time must have been a period of subsidence, at the end of which there came an upheaval, and the second shore line was formed. This beach lies between three hundred and fifty and four hundred feet above

*Ohio Geol., I., p. 377.

the first one, and is characterized by certain impressions of animal remains, worm tracks, and marks made by running water over exposed surfaces of mud. These are tolerably constant at a horizon which corresponds in a general way in various parts of the group, such as Obanyon Creek in Clermont County, and in exposures, near Lebanon, in Warren County.

All the beds which make up the deposits about the city are by no means equally rich in fossil remains. Sometimes a thick stratum is found which is absolutely barren of life; and again another will be found where remains are extremely abundant. What are known as the Eden shales, amounting to nearly two hundred feet in thickness, seem, in places, to be barren of life, although in spots fossils are found in abundance. It has been generally agreed that the bedded rocks of this vicinity were laid down in a deep sea. Now Darwin has shown that thick beds of sediment are seldom deposited except over an area of subsidence, and that it is during this period of sinking that the greatest number of species of animals are preserved. If, therefore, the theory that the epoch of the second shore line was followed by a time during which the land was gradually subsiding, then there should be some record of it preserved in the increased number of species and specimens of fossil remains. The facts known confirm this theory, as will now be shown.

From two tables of species given by Prof. Orton in Ohio Geology, vol. I., pp. 398—399, it would appear that fossils are much more abundant above the three hundred foot horizon than below it. This horizon in fact seems to be the beginning of the appearance of many forms unknown in the strata below, and the remains are much more abundant in number of specimens also. It is stated that beds are met with in the upper part of the group, sometimes five and six feet thick made up entirely of the valves of brachiopod shells. "The free valves," says Prof. Orton,* "can be gathered as perfect in form as sea shells on a modern beach, often retaining the visceral and muscular impressions with the greatest distinctness." Still another proof of the subsidence, and that, too, at a slow rate, is the occurrence at about four hundred feet above low water of about one hundred feet of rock which are almost entirely made up of almost microscopic univalve shells.

These facts show that the period of the second shore line must have been followed by a second epoch of depression, and

*Ohio Geol. I., p. 382.

during this epoch probably a thousand feet of sediment were deposited; for, although but little remains of it now, we must remember that the land has been exposed for countless ages to the degrading and denuding agents of air and water, so that at the close of this final period of subsidence came the last one of elevation, and the land rose above the surface of the water until it stood one thousand, and perhaps fifteen hundred feet above the level of the surrounding sea.

It is noteworthy that the beds of barren shales are found just below the level of the second beach, and the inference is that they were deposited at a period when the sea bottom was stationary, and that it was at the close of this period that the land appeared above the sea level. Finally, Prof. Orton says, that the Cincinnati axis underwent oscillations of level, and the facts above given tend to show plainly this was the case.

Having now discussed the aspect and geological position of the rocks found in the immediate vicinity of Cincinnati, and having seen them raised finally in perfect horizontality above the ocean level, let us examine the agencies which have been in action so long as to change in a wonderful manner the whole appearance of the surface since the time when it emerged as a long ridge with gently sloping sides above the waters.

No sooner is an area of land exposed to the atmosphere than denudation begins. There is an immediate tendency to degrade the summit to the level of the sea, and so actively is the work carried on that it is simply a question of time how soon even a high mountain range is reduced to the ocean level. The newly elevated island of Cincinnati was no exception to the general rule, and although it was not extensive enough to possess any large rivers, the ordinary aerial agencies of air and water would be sufficient to accomplish a great deal in a long period of time. A little furrow in a sloping bank, made by a rivulet, soon becomes by the addition of other rivulets a rapid torrent, and gradually increases in size, volume and power. It sweeps more and more sediment down its sloping channel, and at last casts its burden into the ocean to be there spread out in even sheets upon the ocean floor far from land.

No more striking example of the erosive power of water acting through long periods of time can be seen than in our Western territories in the great Colorado River Basin. Here the

river has excavated a channel through solid rock for hundreds of miles to a depth of from 500 to 7,000 feet. In places, over 10,000 feet of solid strata have been removed over an area of more than five hundred square miles, and all this in an arid region where the rain fall is limited in amount. The region, once an extensive plateau, is now cut up into innumerable canyons and valleys, ramifying in all directions like the veins in a leaf. In a mountainous country the corrading powers of water are correspondingly greater, and what was once a smooth mountain side will in time be cut up into ravines innumerable. Capt. Dutton in his interesting account of the Hawaiian Volcanoes* pictures what will result in the course of thousands of years were the forces now in action to continue their work. "As in every other mountainous country," says he, "the ravines would grow wider, their sloping sides would be gradually pared away, and the rocks reduced by secular decay to sand and soil. The silt would be carried off by the running streams to the ocean, and the remnants of the sloping platforms between the ravines would grow narrower until at length they were reduced to knife edges, and would still continue to dwindle in size." Again, he says:† "Whenever a great valley or gorge is eroded in a large mountain mass, the head of the valley forms an amphitheater, or series of amphitheaters, with abrupt or precipitous ravines immediately beneath the peak. In general terms, as we follow such a ravine from the plains below upward toward the summit, the grade of its bed becomes steeper to the very last. Again, where two or more mountain gorges descending on different sides of the cone reach far up toward the summit so that their upper portions are separated only by a narrow divide, then this divide will always be sharp and well preserved through all stages of erosion."

To give a few examples of the wearing powers of water in a short time, I will quote a paragraph from Dana.‡ "Lyell mentions the case of the Simeto, in Sicily. In two and a half centuries it had excavated a channel fifty to several hundred feet deep, and in some parts forty to fifty feet wide, although the rock is a hard solid basalt. He also describes a gorge made in a deep bed of decomposed rock, three and a half miles west of Milledgeville, Georgia, that was at first a mud crack a yard deep in which

*Fifth Annual Report of U. S. Geol. Sur., p. 213.
† Ibid, p. 207.
‡ Manual of Geology, p. 647.

the rains found a chance to make a rill, but which, in twenty years, was 300 yards long, 20 to 180 feet wide, and 55 feet deep. And Liais describes a similar gorge, of twice the length, in Brazil, made in forty years."

Many other instances of the wearing away of the rocks by water might be given, but these will suffice to show that during the long periods of time that have elapsed since the Cincinnati island was first elevated above the water, there has been ample opportunity for extensive denudation, and it is no wonder that the face of the country is vastly altered. Let us now proceed to examine the situation of the city, and see if we can trace the history of the present conditions.

Such an investigation is beset with many difficulties. Not the least of these are the changes which have been wrought by the gradual growth of the city, and the encroachment upon the high ground which partly surrounds it. Laying out streets and building lots; leveling elevations, and filling valleys, tend to greatly change the aspect of the country. So that what was once rolling land becomes level; what was once the bed of a raging torrent or a gently murmuring brook, becomes a covered drain; what was once an abrupt height becomes a gentle gradient; and what was once a level plateau becomes marked by the innumerable excavations made in the process of quarrying stone. All these changes must be considered in a study of this sort, although some few reminders are often left to guide us to a correct view of what was once.

Cincinnati proper occupies an extensive plain or bottom land extending in a semi-circle, with the Ohio river on the south, and a series of elevations on the north known commonly as Mt. Adams, Walnut Hills, Clifton Heights and Roe's Hill. At the western side of the city is the extensive valley of Mill Creek, a valley several miles wide, and extending many miles to the north and northeast. Beyond Mill Creek is another elevated ridge, at the south end of which is situated the suburb of Price Hill. South of the Ohio river lie Covington and Newport, divided by the Licking river, and occupying part of the same extensive plain upon which Cincinnati is built. These two cities are encompassed on the south by a range of highland extending in a semi-circle, similar to the range on the north side of the river.

In what is now the main business part of the city, the plain has two terraces. One of these finds its level approximately

where Pearl street is laid out, and the other follows in its general direction Fourth street. Both these levels decline toward the west and northwest, and finally melt away into Mill Creek valley. Low water mark of the Ohio river is 432 feet above tide water at Albany; the Pearl street level between Broadway and Vine is about seventy feet higher, or 500 feet above tide water, and the Fourth street level is about forty feet higher.

Tell a citizen of Cincinnati that there are no hills in or about his city, and he will laugh at you; tell the same to a resident of Clifton, Walnut Hills, Mt. Auburn, or any of the so-called "hill-top" suburbs, and he may call you crazy. For they would consider it an absurdity to be told this when they must, nearly every day of their lives, be hauled up inclined planes, and carried by cable roads, or horses, 300 feet or more above the level of Fourth street. Yet to say that there is not a hill in or about Cincinnati, or even in Hamilton County, would be but telling the strict truth. There are elevations, but no true hills, for a hill is a mass of earth raised above the general level of the surrounding country. If Mount Auburn towered above Walnut Hills as high as it stands above Fourth street, and from its top one could command a view of the country far and wide, then indeed it would be a true hill. But such is well known not to be the case, and a study of our city's surroundings will reveal the real state of affairs and show its "hill-top" resorts to be the remnants of a once extensive level or nearly level plateau.

If we go to Eden Park and stand awhile on the brow of the hill beneath the shelter house, and look down upon Gilbert avenue, we note several things. Back of us are ledges of rock projecting from the bank, below us are other ledges of the same character. If we turn our eyes to the westward, across the deep valley of Deer Creek, on a level with where we stand we see another bank, out of which also project rocky ledges of the same character as those near us. Turning our gaze gradually to the north and thence to the east, we perceive one, two, three, four, similar perpendicular banks, out of which project the same kind of ledges. All these are evidently on a level, and it takes but a short time to conclude that all the ledges were once united, and formed a continous floor from where we stand across Deer Creek valley to Mt. Auburn, and up to the northward. In imagination we see the valley filled with limestone rock piled ledge upon ledge and forming a level plateau stretching away as far as the eye can see.

If we go now to the east end of Eden Park, on the steep bluff overlooking the river, we find the same rocky ledges. All along the bank, farther than we can see, it is the same, and could we look into the Kentucky banks just opposite, the same layers would be found. But before being perfectly sure of what we suspect to have been the case, let us journey to west of Clifton Heights, in the neighborhood of the great quarries. Here, better than anywere else, can be seen the evenness and regularity of these rocky ledges. Great quantities of earth have been removed and great holes have been cut into the solid limestone. Hundreds and thousands of perch of stone have been carted away to form foundation walls for innumerable buildings. If now we walk westward we find the ledge continues under our feet, and we finally pause on the brink of the precipitous bank overlooking Mill Creek. Looking again westward, the same ledges crop out of the bank. Not a doubt can now remain that there once stretched an extensive plateau from the Kentucky shore back of Dayton across what is now the Ohio valley, through Eden Park, over Deer Creek valley, through Mt. Auburn, Clifton Heights, and across Mill Creek valley to the opposite bank and far beyond. The various valleys and ravines are seen to have been excavated in this plateau, and the diversified aspect of the country is due to the erosive powers of water, acting through immense periods of time. There is one other force which has at one time had something to do with altering the appearance of the country hereabouts, and that is moving ice. When during the glacial era a large part of the North American continent was covered with an immense mass of ice, in places five, six, ten thousand feet thick, it was a powerful erosive agent. For it swept over the surface of the land, plowing it out here, filling it up there, overtopping hills, or sweeping round projecting or insurmountable points.

At the close of this period the whole face of the country bore a very different aspect from what it had previously borne. In places immense piles of debris remained, forming banks many miles long, and many feet high. When these were in the beds of former streams, it became necessary for the stream thus barred out to seek a new channel, and it varied from its former course more or less, in accordance with the amount of material left in its bed. Many streams were compelled to form entirely new channels, but others had to carve new courses only in places here and there. The Ohio river seems to be one of those placed in the latter cate-

gory, for in many places its valley is too wide and too deep to have been excavated by the volume of water now flowing at ordinary stages. In fact there seems little doubt but that the Ohio flows in a channel which was cut long previous to the glacial period. This old channel has been largely filled up, and the river now flows from thirty-five to forty feet above its ancient bed. This seems to be conclusively proven by the discovery at that depth below the present surface of the ground of an extensive bed of carbonaceous material consisting of stumps of trees, leaves, seeds, and other vegetable remains. This layer doubtless once formed a sort of bottom land, and the material overlying it must be referred to a later epoch and one which seems contemporaneous with the period of the glaciers.

This superposed material, forming in main the terrace upon which the city stands, is composed, according to Prof. Orton,* "Of distinctly stratified gravel and sand of varying degrees of fineness and purity. The gravel stones are all water-worn. In weight they seldom reach ten pounds. The upper tributaries of the Ohio supply the materials in part, but a much larger proportion in the vicinity of Cincinnati is derived from the limestone rocks of Western Ohio and the crystalline beds of Canada." "The leading facts in the structure of the terraces show that their history is not to be explained by the present conditions of the continent. They must have been formed under water at a time when the face of the country held a lower level than it does now by one hundred or more feet."

The gravel and sand of the terraces varies greatly in different quarters. In some places, as has been revealed in excavations in different quarters of the city, it is coarse and mostly composed of large pebbles mixed with a small quantity of clay and sand. Fourth street, Broadway, and many other streets are on gravelly foundations. Again, the gravel is replaced by fine sand, as for example on West Eighth street, near Mound, Vine, near Fifteenth, and others; while in still other places the subsoil is a heavy, stiff clay, very close and fine grained and exceedingly difficult to work. One pocket, as it seems to be of this material, is in the vicinity of Pike and Pearl streets. It goes by the name of "Springfield clay." It is this clay, so Prof. Orton states, which was used in paving the floor of Eden Park Reservoir. These various deposits, sometimes extremely local, show varying conditions existed; in one place a

*Ohio Geol., I., p. 431.

rapid flow of water, in another a slow and gentle movement, and in still others eddying currents which deposited the sediment in compact beds.

If the course of the Ohio river was different at one time from what it is now, the question arises, where was this previous channel? Several facts seem to point to the conclusion that in the vicinity of our city, in fact on the very site of the city itself, there was once spread out a sheet of water which assumed almost the aspect of a lake. The whole of the ground where are now standing the cities of Cincinnati, Covington and Newport, was doubtless once covered with a sheet of water whose boundaries were the Kentucky highlands on the south, the range of highlands west of Mill Creek valley on the west, and the rocks which form the base of "Indian Hill" on the east. The outlet of this sheet of water, or this lake, was not its present one, namely, past the mouth of Mill Creek, but up what is now Mill Creek valley on one side, and up the Little Miami valley and an ancient channel between Red Bank and Plainville on the other side, of what then formed an island, and which is now occupied by the suburbs of Mt. Lookout, Walnut Hills, Mt. Auburn, Avondale and Clifton. These ancient channels extended northward on the east and west of the island, and united near where Ludlow Grove now is, and thence together held their way northward to Hamilton. There they turned to the west and south, and reached the Ohio river valley as it is now, somewhere near Lawrenceburg, Indiana, by following the course now used by the Big Miami. In those ancient days a barrier of land stretched in as yet an unbroken line from Price Hill across to the Kentucky side, and this compelled the water to find an outlet by the ways we have mentioned.

It is supposed that during the glacial period, the end of an immense glacier extended south as far as the Ohio river, and at Cincinnati so completely blocked the channel as to compel the river to seek a more southern course. But at the close of the ice age, and when the glacier had melted, the river attempted to return to its former channels. Finding, however, its old bed filled with sand and gravel, the debris of the retired ice field, and finding, perhaps, also that the former impassible barrier had lost some of its height, it beat against it, gradually wore it away, and cut for itself a new channel from the mouth of Mill Creek to Lawrenceburg.

It is said that the City of Louisville stands upon part of a filled up channel of the Ohio river, and what are now the falls of the Ohio are the remains of the heavy bedded rocks cut through by the stream in its efforts to form a new channel. It is likely that the same is the case with Cincinnati. The city proper stands upon part of this filled up channel or lake bed, and the new channel of the river has cut far enough into the rocks to sweep away all obstructions and permit free passage to the stream. The remains of the barrier are found in the beds exposed near Ludlow, Kentucky, and above the Cincinnati Southern Railway Bridge (C. N. O. & T. P. R. R.), as well as in what is known as "McCullum's Riffle," a conspicuous bar in low water, a few miles below the city. No doubt that at the period when the barrier stretched unbrokenly across from Price Hill to Ludlow, and when the two previous outlets of the lake were filled with sand and gravel, the water formed a rapid for miles over this barrier. Constant attrition has worn it away, and now it has completely disappeared from the channel, and forms no obstruction to navigation such as is found at the present day at Louisville.

We have thus far traced the geological history of Cincinnati and tried to explain the reasons for its present aspect, but as yet nothing has been said of the minute topography of the city's suburbs. As, however, this paper has already reached a considerable length, the second portion of our subject must be left for another period, when I hope to have collected material to show just how the land is drained, and to point out several as yet unnoted facts in the surface geology.

[TO BE CONCLUDED.]

LANTERN SLIDES.

By E. J. CARPENTER.

(Read at meeting of the Photographic Section May 6, 1886.)

There is probably no other way in wnich a photographer can so satisfactorily show the results of his work as by projecting the views on the screen by means of the so-called magic lantern, and I find in my own experience that many who do not care for or appreciate the best results presented in the form of silver prints on paper are pleased and interested by the same views when shown on the screen. This is no doubt mainly due to the increased size of the pictures, which gives them a reality so vivid that it is not difficult to imagine that the spectator might, if so inclined, step out into the scene presented before him, and I have known children to voluntarily speak to friends whom they recognized, and whose presence seemed so real when presented in this manner.

Fortunately, the production of pictures for use with the lantern is now one of the easiest and simplest of photographic operations. Any negative that will make a passable silver print may be used, and in addition many are available, which by reason of various imperfections cannot be used at all for ordinary printing. The operation is, briefly, to make a transparent positive on glass of the proper size, usually 3¼x4 inches.

The tests of a first rate lantern slide are as follows: The image must be clear and brilliant, having contrast without harshness. The highest lights should be clear glass without a trace of silver deposit; and the deepest shadows should be sufficiently transparent to permit all detail to be seen. When the plate is laid on a white printed sheet the type should be legible through the shadows, and the lights should show no deposit.

The easiest method of making positives is to print by contact in the pressure frame just as is done in silver printing, but for this purpose it is necessary that the negatives should be of the proper size, which is not usually the case unless they happen to have been made specially for the purpose. I have often made contact positives, but only where I wished to use a small portion of a larger negative, or when the slides were to be made by copying photographs or engravings. In the latter case a small negative is made of the copy, usually on a 4x5 plate, which size is large enough to enable one to properly adjust the plate on which the positive is to be made.

If the negative to be copied is larger than the required positive, recourse is had to the camera. The negative is set up in a frame, and the camera is placed facing it in such a manner that the ground glass is parallel to and opposite the center of the negative. It is then moved back or forward until the image of the negative is of the proper size when focused. The operation of focusing is one requiring the greatest care, and is also one which does not, I am afraid, receive the attention its importance demands. Very few people have eyesight sufficiently sharp to enable them to perform this operation without the aid of a magnifying glass, and to those who think they have I would suggest to try the experiment of examining carefully with an ordinary hand microscope any lantern slides made without the use of such a glass to focus the image. The result will probably surprise them, as I will confess it did me when I compared in this way two sets of slides made from the same negatives, one lot made by using the glass to focus, and the other by unassisted, but rather more than usually keen, eyes. Among the most common faults of the various slides submitted for criticism has been this of poor focussing when making the copy. When it is remembered that the operation of once focussing will suffice for probably all the positives to be made during an afternoon or a day, it will be seen that the little time required to do it perfectly is well spent.

The best apparatus and the easiest to use for reducing negatives and making slides is the copying camera, a good specimen of which belongs to this Society. Before making the exposure, if an ordinary camera be used, it is necessary to cover over the space between the lens and the negative to be copied, so as to prevent any light from reaching the lens that does not pass through the negative. If this is not done a brilliant positive will not be obtained, because a certain amount of this extraneous light will be distributed over the sensitive plate, and cause a veiling of the high lights, which ought to be perfectly clear.

If a portrait lens be used in the copying camera, and this form of lens gives most satisfactory results, it will be necessary to stop it down considerably, though even then it will be found that the exposures are shorter than with any of the various view or group lenses. As most lantern slides are made in the winter season when the light is weak, and clouds, smoke, etc., still further impair its activity, it is a matter of some importance to have a quick-working lens.

The duration of exposure depends on so many conditions that the requirements of each plate must be determined on its own merits. Fewer mistakes in exposure will be made if before beginning operations the negatives be carefully looked over and sorted, putting together those which nearest approach each other in density, and which therefore will require approximately the same exposure. Negatives which require special treatment should also be put aside and handled together, as experience gained by dealing with one may be of great service in operating with the next. It frequently happens that a negative otherwise good may have a very thin foreground or a faulty sky, which may be corrected by shading the thin portion during the exposure. For this purpose a piece of opaque paper or thin board may be used, but it must be kept in motion so as to prevent the appearance of shading lines in the copy. Many negatives too thin to print may be made to yield excellent positives on glass by shading them with ground glass or tissue paper, and giving a scant exposure, followed by slow, care ful development.

The copying camera should be pointed toward a clear sky, or toward a part which is evenly covered with clouds. No intervening trees nor buildings should appear on the ground glass of the camera when it is examined with the negative removed from the frame. If any such image can be seen, no matter how indistinctly, it will appear as a dark spot on the finished positive, and as the cause will not be suspected, it may result in the loss of much time and many plates.

For work at night, the negative may be lighted, by one or more lamps with reflectors, but great care is required to secure an even illumination. With the best of the artificial lights which are ordinarily within reach, however, a much longer exposure will be required than for daylight work.

Until quite recently all the best lantern slides were made by the wet-plate process, in fact there were no gelatine dry plates manufactured on which a more than passable lantern slide could be made. At present there are several makers who produce plates on which it is easy to make lantern slides of excellent quality, which are only with difficulty to be distinguished from the best wet-plate work. The latter, however, maintains its position as the standard, on account of its perfect purity in the lights, its trans-

parency in the shadows, and the fineness of the silver deposit composing the image.

The wet-plate process requires perhaps a little more care and experience to attain success, but it is quite simple, being briefly as follows: The first requisite for making any kind of photographic plates is to have the glass perfectly clean. This is accomplished by putting it in any of half a dozen acid or alkaline solutions easily prepared for the purpose, and leaving it there several hours, after which it is removed, scrubbed, and rinsed well in several changes of water. Then follows the abluminizing which consists of flowing over the plate, after the final rinsing, a dilute solution made by shaking up a teaspoonful of white of egg with 8 oz. water and filtering it. The best way is to clean and albuminize a quantity of plates, storing them for use, as they will keep indefinitely. The sensitizing bath is made by dissolving pure nitrate of silver in distilled water, a proper strength being from 35 to 40 grains to the ounce. In the solution is dissolved iodide potassium, one grain to each 8 oz., after which it is acidified by adding nitric acid (c. p.) in the proportion of about 1 minim. of the concentrated acid to 16 ozs. of the bath, which must afterwards be filtered carefully before using. The bath may be kept in a bottle, and poured into a flat glass pan when required for use. To prepare a plate for exposure, dust it carefully, and coat it with collodion by pouring on it a pool near the center, and then by tilting the plate, lowering the corners consecutively, allow the collodion to flow evenly over it, and drain back into the bottle. Any good collodion will answer. I have found that a mixture, equal parts, of Anthony's "New Negative" and "Copying" collodions gives very fine results. After the collodion has set, the plate is placed in the sensitizing bath, where it is allowed to remain until on its being lifted out the solution flows evenly from the surface, without the greasy appearance which it will have if taken out too soon. From two to five minutes is required for sensitizing. The operation is shortened by keeping the bath in motion. As soon as ready the plate is taken out of the bath, drained and placed in the dark slide, after which the exposure should be made as promptly as possiqle.

The usual developer is a solution of protosulphate of iron, made as follows: Sulph. iron 2 oz., acetic acid 2 to 4 oz., water 40 ozs. Care must be taken to cover the plate with a single sweep of the developer, because if it is allowed to flow unevenly streaks

will appear in the film. The image should appear in a couple of seconds, and the development should be complete in from ten to twenty seconds. The plate is then rinsed under the tap, and fixed in a strong solution of hypo-sulphite of soda, after which it is washed for twenty minutes, and then hung on a rack or dried by heat. A better developer is Lea's Sugar Developer, made as follows: In 32 oz. of hot water dissolve 7 oz. of protosulphate of iron, and add 6 oz. white sugar and 2½ oz. acetic acid, which makes the stock. For use take: Stock 7½ oz., acet. acid No. 8. 4 oz., water 18 oz., filter. Add more acetic acid if there is any sign of fogging.

The collodion film is very delicate, and must at no time be touched, or it will be scratched and spoiled. After fixing the plates may be toned in various ways. I prefer a weak solution of chlor. gold, about 1 gr. to 30 oz. water. This is flowed over the plate several times, and requires only a minute or two to act. Bichloride of mercury is often used, and gives a rich purple tone, but I have found that plates thus toned fade considerably in the course of a year or so.

This may seem like a difficult process to those who have been accustomed to the gélatine dry plates, but after the bath has been made and a quantity of plates have been cleaned and abluminized the process is very rapid. I would advise those who try it to provide half a dozen finger stalls of thin rubber, as by using them the silver stains, otherwise inevitable, will be avoided. Excellent dry plates for lantern slides are made by washing and drying collodion bath plates after putting them in a weak solution of acetic acid and flowing over them a strong infusion of coffee. They are developed with pyrogallic acid and nitrate of silver, and give results of the highest quality. They are generally used for printing by contact, as in the camera they are very slow.

I have used but two brands of commercial dry plates success fully for lantern slides—the Anthony Transparency plates and Carbett's Gelatino-albumen. With careful handling these plates give about equally good results, and both almost equal to the best to be obtained by the wet-plate process. Each has, however, its own peculiar advantages and faults. I have thought that the Anthony plates are a little more easily controlled in case of over-exposure, and the Anthony developer is simpler, as it may be made very quickly from saturated solutions of iron and oxalate. The princi-

pal objection to the plates is that the glass varies much in thickness, and is often marred by blebs and scratches, faults due solely to carelessness in its selection.

The glass of the Carbatt plates is about perfect, being thin, clear and uniform. The emulsion requires only about one-half as long an exposure as Anthony's, and when the exposure is just right developes beautifully, but in cases of over-exposure it is not so easily controlled. The best results are always obtained by using the maker's formula for developer, and as this one is somewhat complicated it is not quite so readily prepared, particularly if, as sometimes happens, only one or two slides are wanted.

An excellent plan when a number of lantern slides are to be made is for two men to work together, one to remain in the dark room to develope plates, and the other to make the exposures. By comparing results the proper exposure for the different negatives is readily determined, and in consequence fewer plates are spoiled. The worker outside readily notices changes in the intensity of the light which would escape the attention of one who spent much time in the dark room.

Two men can in this way accomplish far more than if they work independently, and are certain to learn more rapidly, for each will notice some matter of importance that would have escaped the attention of the other. I have found that for this method of working it is well to develope in large trays, about 7x9, and to have at least two developers, strong and weak. Four or more positives may be developed at once, and the work proceeds as rapidly as the exposurers can be made.

Exposures for lantern pictures must be full, in order that detail may be developed in the high lights before the shadows become too dense.

Nothing can be done to save an under-exposed positive, but it must be remembered that only those are under-timed which refuse to develop uniformly when placed in the normal developer.

Generally the most satisfoctory results are attained by trying to expose so that the positive will develop in a solution containing about one-half the normal quantity of iron, and which has also a small quantity of the restraining bromide. If this plan is adopted a plate which refuses to develop properly in the weaker solution is pretty certain to come out when put into the stronger. If plates

are much over-timed it is difficult to manage them, and probably the best plan is to lay them aside and make another exposure. In fact, after one has some experience in making slides, this will be found the best remedy for a faulty plate of any kind. It is so easy to make a good one that it hardly pays to waste time over one which has come to grief.

A much stronger light is permissible for developing lantern slides than for ordinary negative work, as owing to the comparative slowness of the plates, even a tolerably strong orange light is safe. This, of course, adds much to the comfort of the operator, and enables him to proceed more rapidly.

Scrupulous neatness in all photographic work is always well repaid in the results, but in none more so than in the making of these, probably the finest and best of all photographic productions.

NOTE ON A RECENT SYNONYM IN THE PALÆON TOLOGY OF THE CINCINNATI GROUP.

By PROF. JOS. F. JAMES.

(Read June 1, 1886.)

Labechia montifera, Ulrich, vs. STROMATOPORA SUBCYLINDRICA, James.

The first number of "Contributions to American Palæontology," May, 1886, by Mr. E. O. Ulrich, contains descriptions and remarks upon twenty-six species of fossils from the Devonian and Silurian formations of Indiana and Kentucky. These species are distributed among the Bryozoa (sixteen species), Brachiopoda (two species), Gasteropoda (four species), Anthozoa (two species), Hydroida (?) (one species), and Foraminfera (one species). Only one of these species is from the Lower Silurian, Cincinnati Group, and as we are especially interested in this one, a few remarks may be in order.

The species is named *Labechia montifera*, and belongs to that much-disputed class of fossils known as the Stromatoporoids. Whether it belongs to the class under which Mr. Ulrich has placed it (HYDROIDA ?), or to another group is not a question for discussion here. The point to which we wish to call attention is the fact that the so-called new species is an evident synonym for another species described and illustrated in the JOURNAL of this Society in April, 1884, by Mr. U. P. James. It was there named STROMATOPORA SUBCYLINDRICA, and it agrees so well in all its essential characters with Mr. Ulrich's species that one wonders how the error of overlooking it could have been made, as Mr. Ulrich must have been acquainted with the work done here more than two years ago.

In comparing the two descriptions the following points of resemblance are noted. Both are incrusting, in the one case clay, simply, in the other generally "species of *Orthoceras.*" Both are cylindrical or compressed; in both the crust is about one tenth of an inch thick; both have undulating surfaces which are covered with scattered conical "elevations" or "monticules," the slopes of which are marked with "lines" or "ridges." The intervening spaces are in both cases covered by "circular or elongate papillæ," or "granular eminences." In both the internal structure is irregularly porous or vesicular, and lastly the horizons at which the two were found were approximately the same, the one being above Morrow, Ohio, and the other Madison, Indiana. Thus there are no differences between the two which would enable any one to separate them, and the *Labechia montifera* falls to the rank of a synonym of STROMATOPORA SUBCYLINDRICA, James.

THE TERTIARY FAUNA OF NEWTON AND WAUTUBBEE, MISS.

By OTTO MEYER and T. H. ALDRICH.

(Read June 1, 1886.)

The Eocene invertebrate fossils, described and enumerated in the following, were collected in March, 1886, by O. Meyer in Eastern Mississippi, near Newton, Newton County, and near Wautubbee, Clarke County. A great part of the material from Newton, however, was collected afterwards by Dr. E. A. Smith and T. H. Aldrich. The deposit near Wautubbee was first known to the Hon. L. R. Johnson, of the United States Geological Survey. For a description of the geological relations of these strata see American Journal of Science, July, 1886. The type-specimens of the new forms described are in our collections.

DESCRIPTION OF NEW FORMS.

In the following descriptions of univalves the term "transverse" is understood to be rectangular to the suture.

GLOSSOPHORA.

Dentalium incisissimum, n. sp.

Plate II Figure 1.

Smooth, polished, gradually tapering. Section circular. Aperture with a long narrow slit.

Wautubbee.

Cadulus abruptus, n. sp.

Plate II. Figure 2.

Rather large, somewhat depressed. Inflation very near to the larger aperture and suddenly decreasing.

Newton, Wautubbee.

The type specimen is from Newton. Form and position of the inflation distinguish it from the other species of Cadulus of the Southern Tertiary.

Cadulus, sp.

Plate II. Figure 3, 3*a*, 3*b*.

Two depressed fragments from Newton show an aperture which is different from the other known apertures of Cadulus of

the Southern Eocene. Two distant deep notches on the convex side, and two less distant emarginations on the concave side of the shell divide the margin of the elliptical aperture into four appendages, of which the two small opposite ones are equal, the two larger ones, however, very unequal. It may be that this form represents the aperture of the preceding species, of which we have no example. If, however, the form should prove to be a new species we propose the name *Cadulus Newtonensis* for it.

Fissurella altior, n. sp.

Plate II. Figure 16, 16*a*, 16*b*.

Height two-thirds of the length of the aperture. Fissure on the apex, nearly circular. Surface covered by alternating, radiating and revolving ribs. The crossing points of the larger ribs are mostly nodulous and scaly.

Wautubbee, Newton.

The type specimen is from Wautubbee. *Fissurella Clairbornensis* Lea is lower, has an oblong and less central fissure, a different sculpture and a different inside.

Solarium elegans Lea var. *modestum*, n. var.

Plate II. Figure 6, 6*a*.

Like Solarium elegans Lea from Claiborne, but without ornamentation, the row of tubercles along the suture excepted.

Wautubbee.

Scalaria (*Opalia*) *albitesta*, n. sp.

Plate II. Figure 7.

Whorls sessile, rather gradually diminishing in size, covered by lamellar transverse ribs, which are continuous along the whorls.

Newton.

Opalia sessilis Conr. from Claiborne has revolving lines.

Scalaria Newtonensis, n. sp.

Plate II. Figure 8.

Whorls regularly rounded, gradually diminishing in size. They are covered by very fine revolving lines, which on the middle of the whorls are arranged in bands, about five in number.

The very prominent transverse ribs, about nine on each whorl, are lamellar, angularly produced above; their margin is reflected to the right. The fine revolving lines continue on their right side. The left side, however, is sharply defined from the surface of the whorls. The ribs continue over the base, which is defined by an elevated carina. Aperture circular.

Newton.

Eglisia retisculpta, n. sp.

Plate II. Figure 9.

Spire subulate. Whorls regularly rounded. Covered with five elevated, flattened longitudinal lines, crossed by numerous oblique, flattened, transverse ribs, smaller in size. Aperture elliptical.

Wautubbee.

Natica Newtonensis, n. sp.

Plate II. Figure 12.

Shell thick. Depressed globular. Spire low. Suture distinct. Whorls six, convex; body whorl flattened above. Umbilicus deep. Inner lip somewhat spreading over the body whorl.

Newton, Wautubbee, Lisbon, Ala.

The type specimen is from Newton. The form is characterized by its robust, subquadrate shape.

Sigaretus, subg. *Sigatica*, nov. subgen.

Shell globosely auriform. Umbilicus wide. Inner lip without callus. Umbilicus, basal and upper part of the whorls spirally striated.

This subgenus approaches *Natica*.

Sigaretus (*Sigatica*) *Boettgeri*, n. sp.

Plate II. Figure 13.

Spire nearly one third of the shell. Whorls five, flattened above. Suture distinct. Spiral lines near the margin of the umbilicus very strong.

Newton, Miss., Lisbon, Ala.

Sigaretus inconstans, n. sp.

Plate II. Figure 18, 18*a*.

Auriform. Flattened. Covered by elevated, flattened striæ. Three and a half whorls, the last of which is finely striated,

constitute the nucleus, which is situated near the margin. Its plane does not coincide with the general plane of the shell. Umbilicus hidden by callus.

Newton.

There is only one flattened species of Sigaretus known from the Southern Tertiary, *Sig. arctatus Conr.* Its nucleus, however, is not marginal and lies in the plane of the shell.

Cerithiopsis quadristriaris, n. sp.

Plate II. Figure 5.

Subulate. Whorls flat, covered by four smooth, elevated spiral lines, with nearly equal distances. The two in the middle are smaller than those near the sutures. Suture defined by a very small, elevated revolving line.

Newton, Miss., Claiborne, Ala.

The type is from Newton.

Cassidaria planotecta, n. sp.

Plate II. Figure 14.

Spire very much flattened. Three and a half embryonic whorls form a subglobular nucleus. Adult whorls four. Body whorl with two carinas, the upper one carrying subspines. Surface covered with rather distant, elevated, revolving lines. Inner lip spread over the body whorl. Columella irregularly tuberculated.

Newton.

The figure on the plate, though still representing a fragment, is restored from two specimens. The form is characterized by its flat spire.

Columbella mississippiensis, n. sp.

Plate II. Figure 17.

Spire elevated. Whorls nine, slightly convex; the last four with an impressed line along the suture. Base of body whorl spirally striated. Columella excavated, anteriorly with three tubercles. Outer lip thickened, crenulated within by about seven striæ, of which one in the middle is the largest.

Newton.

Fusus Newtonensis, n. sp.

Plate II. Figure 11.

Short fusiform. Aperture and canal more than half the length of the shell. Whorls regularly rounded. More than three

smooth embryonic whorls form the nucleus. They are followed by four adult whorls. These are covered by elevated, revolving lines, which alternate on the whorl body, and which are crossed by elevated lines of growth. The last three whorls besides are ornamented by prominent, obtuse, transverse folds, about ten on each whorl, sigmoidally bent on the body whorl. Aperture angular posteriorly. Outer lip sharp, striated some distance within. Callus spread over the columella. Canal recurved.

Newton.

Fusus subscalarinus Heilpr. has whorls which are flattened on their upper part, while those of *Fus. Newtonensis* are convex.

Murex cancellaroides, n. sp.

Plate II. Figure 15.

Short-fusiform. Aperture and canal less than half of the length of the shell. Embryonic whorls three. Adult whorls five with crowded oblique, rib-like, varices, becoming obsolete on the body whorl. They are covered by numerous, alternating, prominent, elevated, revolving lines. Columella, with an umbilicate fissure. Canal short, straight. Aperture regularly rounded posteriorly. Outer lip thickened, crenate within, the crenation at the middle of the whorl being the strongest.

Newton.

Only the figured specimen has been found.

Marginella constrictoides, n. sp.

Plate II. Figure 10.

Biconical. Spire more than a third the length of the shell. Whorls six, flattened. Columella, with four folds, the uppermost nearly horizontal, the lowest nearly vertical. Aperture straight. Outer lip thickened, crenate.

Newton.

Marginella constricta Conv. from Claiborne is similar; but has the outer lip angular posteriorly, five plaits on the columella, which are besides of different shape and position, has a lower spire and is smaller.

Cylichna volutata, n. sp.

Plate II. Figure 4.

Cylindrical, top regularly conical. Aperture straight, widening anteriorly. Columella anteriorly with a nearly vertical fold.

Newton.

Indistinct revolving impressed lines are only visible under a strong glass. The conical top is distinctly defined from the cylindrical body.

LAMELLIBRANCHIATA.

Plicatula planata, n. sp.

Plate II. Figure 20.

Covered by small, radiating ribs, consisting of scales and scaly spines. They are larger in rather regular intervals, especially on the sides, and their spines are sometimes rather long. The umbonial part, however, is smooth.

Newton, Wautubbee.

The type specimen is from Newton.

Pecten pulchricosta, n. sp.

Plate II. Figure 23, 23*a*.

Convex, covered by eight broad, rounded, radiating ribs, perceptible in the inside; those in the middle are the largest. Near the ventral margin they dissolve into more numerous ribs.

Wautubbee.

Only the figured valve is known.

Venericardia complexicosta, n. sp.

Plate II. Figure 21, 21*a*.

Rather small. Cordate. Very much inflated. Beak large. Covered by compound, elevated ribs, crenulated near the umbo. They consist of a large median and two small side-ribs. Margin crenulate within, in correspondence with the outer ribs.

Wautubbee.

Venericardia Mooreana Gabb, from Texas, and *Ven. perantiqua* Conr. (*V. subquadrata* Gabb), from New Jersey, have similar ribs, but are less inflated; have a rounded ventral margin and a smaller beak.

Corbula Murchisoni Lea var. *fossata* n. var.

Plate II. Figure 22.

Like *Corbula Murchisoni* Lea, from Claiborne, but the concentric ribs terminate rather abruptly at a depressed line along the carina. Between this line and the carina there are double the number of small concentric ribs. The form, besides, is smaller than in Claiborne.

Newton; Wautubbee; Lisbon, Ala.

The type specimen is from Newton. The sharp and well defined depression along the carina of the umbonial slope is so striking and seems to be so characteristic for the horizon, Newton-Wautubbee-Lisbon, that some might consider it more practical to give to the form a new specific name. This, however, would not show its close relation to *Corb. Murchisoni.*

Neæra (*Cardiomya*) *multiornata*, n. sp.

Plate II. Figure 19.

Posterior half of the surface, with six radiating ribs, the stronger the more posteriorly they are. They alternate with smaller radiating ribs, which do not cover the umbonial part. Anterior half of the surface covered by numerous radiating ribs; its umbonial part is covered by strong concentric ribs, which terminate abruptly at the first radiating rib of the posterior half.

Wautubbee.

Only the figured damaged specimen has been found.

Xylophaga (?) *mississippiensis*, n. sp.

Plate II. Figure 24.

Globular, widely gaping in front. Divided by a radiating line into two parts. The posterior part is convex and covered by indistinct, distant concentric lines. The anterior part is globularly rounded and covered by sharp, elevated, somewhat waving concentric ribs, smaller and crowded on the umbonial part. Its anterior margin is reflected.

Newton.

One single specimen has been found.

LEPADIDÆ.

Scalpellum subquadratum, n. sp.

Plate II. Figure 25.

Carina only known. Its umbo at the apex, pointed. Tectum and parietes flat.

Wautubbee.

Resembles very much *Scalpellum quadratum*, Dixon, sp. (C. Darwin, Fossil Lepadidæ, p. 22, pl. I , fig. 3.), from the English Eocene.

Cephalopoda.

Belemnosis Americana, n. sp.

Plate II. Figure 26, 26*a*.

Phragmocone rather long, straight, with horizontal sutures. Rostrum obtusely conical below, quadrangularly flattened above.

Wautubbee.

Only one specimen of this genus has heretofore been known. It is from the London clay, and seems to be less perfect than our type.

Enumeration of the Species Found.

Glossophora.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.
Dentalium alternatum, Lea	o	o	o	o		o
Dentalium incisissimum, Mr. & Ald		o				
Dentalium minutistriatum, Gabb	o	o		o	o	
Cadulus abruptus, Mr. & Ald	o	o		o		
Cadulus, sp.	o					
Fissurella Claibornensis, Lea	o	o	o			o
Fissurella altior, Mr. & Ald	o	o				
Solarium Meekanum ? Gabb	o				o	
Solarium scrobiculatum, Con	o		o	o	o	
Solarium bellastriatum, Con	o	o				o
Solarium vespertinum ? Gabb	o	o			o	
Solarium ornatum, Lea		o	o	o		o
Solarium, sp.	o	o		o		
Solarium elegans, Lea var., modestum, Mr. & Ald		o				
Solarium nitens, Lea sp		o	o			
Discohelix rotella, Lea		o	o			
Scalaria (Opalia) albitesta, Mr. & Ald	o					
Scalaria Newtonensis, Mr. & Ald	o					
Eglisia retisculpta, Mr. & Ald		o				
Turritella Mortoni C. (=T. carinata, I. Lea)	o	o	o	o		

Glossophora.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.	
Turritella carinata, H. C. Lea........	o		o				
Siliquaria Claibornensis, Lea......	o	o	o				
Trochita trochiformis, Lea.	o	o	o	o		o	
Hipponyx pygmæa, Lea.............	o	o	o			o	
Natica mamma, Lea................	o	o	o	o			
Natica semilunata, Lea.............	o		o			o	
Natica minor, Lea..................	o		o	o	o		
Natica Newtonensis, Mr. & Ald..	o	o		o			
Sigaretus (Sigatica) Boettgeri, Mr. &							
Ald.................	o			o			
Sigaretus striatus, Lea sp.	o		o	o			
Sigaretus inconstans, Mr. & Ald.	o						
Eulima notata, Lea sp..............	o		o				
Niss umbilicata, Lea sp.............	o	o	o				
Odostomia elevata, Lea sp......... ..		o	o				
Odostomia, sp......................	o						
Triforis major, Mr..................		o	o				
Cerithiopsis nassula C. (=C. Langdoni	o		o				
Aldr.).........		o					Red Bluff.
Cerithiopsis Aldrichi, Mr....	o	o	o			o	Red Bluff.
Cerithiopsis quadristriaris, Mr. & Ald..	o		o				
Cassis, Crevicostata, Con............	o		o				
Cassidaria planotecta, Mr. & Ald......	o						
[1.] Distortrix septemdentata, Gabb ..	o				o	o	Sowilpa Cr'k, Ala.
Pseudoliva pyruloides, Lea...........	o	o	o	o	o	o	
Phos cancellatus, Lea sp	o		o				Hatchebigbee.
Columbella mississippiensis, Mr. & Ald.	o						
Fusus Meyeri, Aldr.......	o						Wood's Bluff.
Fusus raphanoides C. (=Clav.							
humerosa C.)....................	o	o	o			o	
Fusus altilis, Con...........	o		o			o	
Fusus venustus, Lea................	o	o	o				
Fusus Mortoniopsis, Gabb......	o	o		o	o		
Fusus pagodiformis, Hlpr....	o			o	o		Wood's Bluff
Fusus Newtonensis, Mr. & Ald	o						
Fasciolaria Moorei, Gabb...........	o				o		
Latirus, sp........................		o					
Caricella reticulata, Aldr....	o	o					Red Bluff
Murex engonatus, Con.......... ..	o		o	o		o	
Murex Vanuxemi ? Con	o						
Murex angulatus ? Mr................	o						
Murex cancellaroides, Mr. & Ald......	o						

GLOSSOPHORA.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Weelock, Tex.	Jackson.	
Odontopolys compsorhytis ? Gabb......	o	o		o	o		
Voluta Vanuxemi, Lea.	o	o	o	o	o		
Mitra fusoides, Lea, var.............	o	o					
Mitra pactilis C., var. dumosa C......	o	o		o		o	
Mitra lineata ? Lea	o	o					
Mitra biconica Whitf...	o	o		o			
Marginella ovata, Lea...............	o		o				
Marginella constrictoides, Mr. & Ald	o						
Ancillaria staminea C. (=Ag. punctuli-	o						
fera, Gabb)	o	o	o	o	o		Wood's Bluff.
Oliva Alabamiensis, Con............		o	o				
Oliva Phillipsii ? Lea......	o	o					
Terebra divisura, Con. var...........	o	o	o	o	o		
Terebra gracilis, Lea (=T. multiplicata							
H. C. Lea)......................	o		o	o			
Conus sauridens, Con..............	o		o	o	o	o	
[2] 20 species of Pleurotoma from both							
localities........................							
Chiton eocensis, Con...............		o	o				
[3] Bulla Aldrichi Langdon (B. bium-							
bilicata, Mr. var.)................	o		o				
Cylichna St. Hilairii, Lea, var.........	o	o	o	o			
Cylichna volutata, Mr. & Ald.........	o						
Volvula minutissima ? Gabb...	o						
Actæonina subvaricata, Conv.........	o	o	o				
LAMELLIBRANCHIATA.							
Ostrea sellæformis, Conv.	o	o	o	o			
Ostrea Johnsoni, Aldr..	o			o			Monroe Co., Ala.
Plicatula Mantelli, Lea...............	o	o	o				Enterprise, Miss.
Plicatula planata, Mr. & Ald..........	o	o					
Pecten Deshayesi, Lea...	o	o	o				
Pecten scintillatus, Con.............	o	o		o		o	
Pecten pulchricosta, Mr. & Ald.		o					
Area rhomboidella, Lea	o	o	o	o		o	
Area aspera, Con	o	o				o	
Pectunculus Broderipi, Lea........ ..	o	o	o	o		o	
Limopsis declivis, Con.............	o	o	o				
Limopsis ellipsis, Lea sp............	o	o	o				
Limopsis obliquus, Lea sp	o	o	o				
Nucula ovula, Lea.................	o	o	o	o		o	
Leda multilineata, Con.............	o	o		o		o	

GLOSSOPHORA.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock. Tex.	Jackson.	
Leda sp. (allied to L. improcera C.)...	o						
Leda sp.		o					
Venericardia Sillimani, Lea	o	o	o				
Venericardia rotunda, Lea............		o	o	o			
Venericardia complexicosta, Mr. & Ald.		o					
Crassatella alta, Con................	o	o	o	o			
Crassatella protexta, Con............		o	o	o		o	
Chama mississippiensis, Con..........	o	o					Red Bluff.
Mysia rotunda, Lea sp	o	o	o	o			
Cytherea minima, Lea...............		o	o			o	
Cytherea Hydii ? Lea................	o						
Cytherea Poulsoni ? Con.............	o						
Tellina nitens, Lea sp................	o	o	o	o			
Mactra parilis, Con..................	o	o	o	o		o	
Corbula Alabamiensis, Lea....		o	o	o		o	
Corbula engonata, Con......... ...	o	o					Red Bluff.
Corbula Murchisoni, Lea var. fossata, Mr. & Ald.......................	o	o		o			
Neæra multiornata, Mr. & Ald........		o					
Teredo simplex, Lea..................		o	o				
Xylophaga ? mississippiensis, Mr. & Ald	o						
DIVERSA.							
Platytrochus Stokesii, Lea............	o	o	o	o		o	
Endopachys Maclurii, Lea............	o		o	o		o	
Flabellum Wailesii, Con..............	o	o		o		o	
Three other species of Corals..........							
Three species of Bryozoa.............							
Scalpellum eocenense, Mr.............	o	o	o	o			Entreprise.
Scalpellum subquadratum, Mr. & Ald..		o					Monroe Co., Ala.
Belosepia ungula, Gabb		o		o	o		
Belemnosis Americana, Mr. & Ald....		o					

NOTES.

[1] *Distortrix Jacksonensis*, Mr., though different from *D. septemdentata*, Gabb, is so closely related to this species, that it is probably better to consider it a variety.

[2] The present state of the American Tertiary literature is such that a determination and description of all these species of *Pleurotoma* must be postponed.

[3] *Bulla Aldrichi*, Langdon, is a synonym of *B. biumbilicata* Mr. As, however, the latter name is preoccupied by the similar and perhaps identical *B. biumbilicata*, Desh., Mr. Langdon's name has to be used at present.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Paper Contributed by J. RALSTON SKINNER, Dec. 1, 1885.

Very fortunate conditions seem to make the identification of the *unit of measure* of the Mound Builders of the Ohio valley both simple and easy of demonstration. One may go further, and say *certain* of demonstration, because certainty rests upon but two matters of fact, which on examination will probably be pronounced established.

The first of these facts is this: That the measures of a great number of these mounds in the river valleys, and on the river terraces of the State of Ohio, as reported by E. G. Squier and E. H. Davis in their great and now somewhat famous work, "Ancient Monuments of the Mississippi Valley," published by the Smithsonian Institution in the year 1848, are to be relied on. It is but fair to say that they are reliable; both from the reiterated statements of these gentlemen and because the Smithsonian Institution gave the work place in its archives. Independently of these considerations the reported measures of these gentlemen contain intrinsic evidence that they were correctly taken, so strong, that we may adopt them as established data for the purposes of our investigation. When this evidence is coupled with (1) the character of the men reporting the measures, (2) the fact that their labors were approved of by and confirmed by Mr. Charles Whittlesey, Topographical Engineer of the State of Ohio, whose surveys of these mounds were made officially, under an act of the State of Ohio, for geological and topographical surveys, and contributed as part of the work of these gentlemen, after they had, as to many, verified and confirmed them, and (3) the acceptance and approval of the institution named, it seems but reasonable to accept it as decisive of the matter. This intrinsic evidence will be quite elaborately given, with a number of quotations as to the character of the surveys, and as to the impressions of the surveyors, taken here and there from their descriptions.

The second of these facts is as follows: The key to this matter is a *stone measure* now in possession of The Cincinnati Society of Natural History. This stone was found in and dug out of

the Sixth and Mound street mound in the City of Cincinnati at the time of its removal, by Mr. C. P. Gridley, now of the City of Springfield, Ohio. He deposited it in the collection of The Western Academy of Natural Sciences, where it was labeled as contributed by him; the original label being now on the stone. The collection of The Western Academy of Natural Sciences, this stone being part of it, passed into the possession of the present society. This is fully verified by the statement of Mr. Gridley himself made to Dr. H. H. Hill, an officer of this society, December 5, 1878, on the occasion of his (Mr. Gridley) coming to this city (Cincinnati) for the purpose of obtaining this stone. The statement is so important that it is made a part of this paper in Appendix A. The elliptical mound in which this stone was found is the same in which was recovered the "*Gest Tablet*" as to which so much has been said and written. (See Appendix C.)

The writer of this paper, while making investigation into the origin of our British measures, was amazed at the ancient universal use of like achitectural symbols all over the world in all lands. Very especially at the almost identity of geometrical display of the Mound Builder's remains with that of the old Egyptian and Hebrews. While examining into this matter in the works of Squier and Davis, spoken of, he was astonished to find that the reported measures given in British feet were such in numbers that a system was disclosed in the general construction, which system could not have been disclosed had any other unit of measure than the British inch been used. So impressed was he with the fact, and yet so impossible did it seem, that in a work, entitled "Source of Measures," published in the year 1875, he made the following remark: "Mounds showing British measures. In searching in the works of Squier and Davis a great number of measures were found, and it was very observable that the English measures seemed so fitting that it was difficult to free the mind from dwelling on their use in the original construction. These measures seemed to be multiples of 3, 4, 6 and 12, and kept running toward the value 360. These facts were noted at the time as curious; but any possible connection seemed, even as it does now, but a wild freak of the imagination, and the matter, though noted, was dropped."

It happened fortunately, that Mr. R. B. Moore, a member of The Cincinnati Society of Natural History, and former President

thereof, became interested in the various discoveries set forth in the works of the writer as to the origin and ancient use of the British measures; as also in the suggestion of their use in the construction of the Mound Builder remains. Having his attention turned that way, it occurred to him to take the measure of the Gridley stone, the outlines of which are here given:

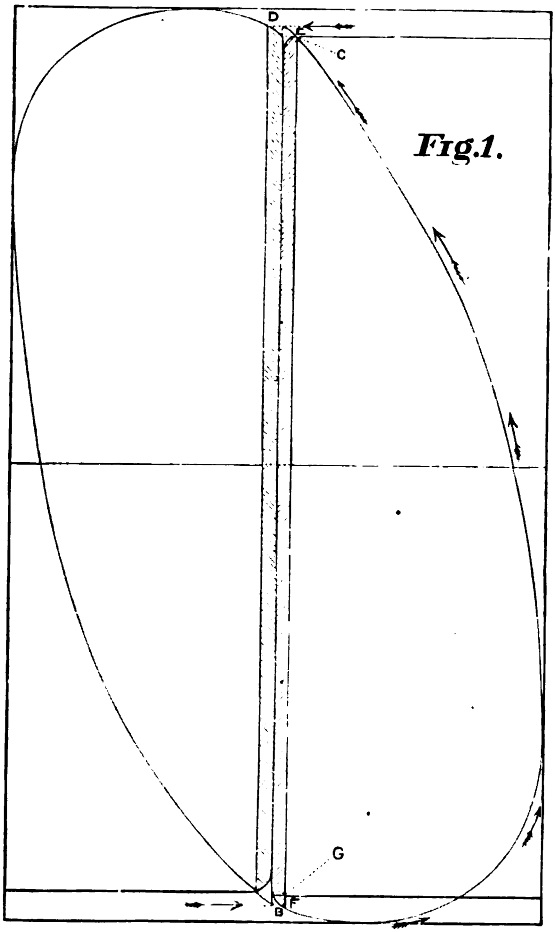


Fig.1.

Fig. 1. Around the curve from the shoulder of the stone above *B* in direction of the arrows to *E* is 12 standard inches. The right line face between these is 9 standard inches. The stone is the half of the ellipse and drawn twice, reversing it. The figure is reduced *one-half* size from the exact *fac simile*. The edge of the stone on diameter is beveled, and right line *CF* is 9 inches also. From *E* to *D* to fill the space of the worn point is 11-50 of an inch. The measure of the curve was made December 21, 1882, by use of a strip of firm paper, and referred to a standard rule.

As seen it is the symmetrical half of a nearly perfectly pro portioned ellipse, the straight edge or line being the diameter thereof. On measuring the straight edge, or diameter line, Mr. Moore found it to be precisely nine (9) standard inches, and on measuring the curved edge, or half circumference of the ellipse, he found it to be exactly twelve (12) inches. That is, the measure was that of the folded "*two-foot rule*," but in such form of presentation that the foot, or 12 inches, inseparably connected itself with the measure of 9 inches. The extreme ingenuity of the device certainly does honor to the Mound Builders, for $9\times12=108$, while $9+12=21$ five times which is 105, and these two are the typical or key numbers of measures used in the construction of the great and most prominent works in the valley. In addition to this $108+105=213$, which is a circumference value of a circle whose diameter is 67.8, the *pi* ratio being 35.5 to 113, to be found in the Dunlap works. So also $9\times32=288$, the number of the measure of that particular circle at Newark, on which Squier and Davis lay especial stress. This combination of measures, as will be seen, is used throughout the Ohio works, whether great or small, of whatever geometrical shape. Mr. Moore made a wooden copy of the stone which he gave the writer, telling him of the measures. But really the statement did not affect him, even to making a trial for the truth of the claim, merely because the fact was so extremely unlikely that it was without consideration rejected. It was not until some two or three years afterward, viz; in the fall of this year, 1882, that the writer's attention was again turned to this matter, from reading in Mr. Wilson's Work, a description of the measures of the Gest Tablet, viz: length 5 inches, greatest width 3 inches, least width 2.6 inches. The fact that both were found in the same mound, and also the fact that Mr. Moore had told the writer that the elliptical stone measured "precisely 9 and 12 inches;" coupled with this statement as to the Gest Tablet, determined him to make the measures of both. He spent the longer part of one afternoon, repeating the trial tests over and over again. A standard measure being used for reference, it was found that Mr. Moore had not exaggerated, but had stated a plain fair fact. The elliptical stone, on its straight edge did measure precisely 9 inches, and around its curved edge precisely 12 inches. The writer requested Mr. Joseph James to make the test also, who took the measures with the like showing. Since then it has been

measured by various parties with the same results. Moreover, it was proved that the stone was approximately the symmetrical half of an ellipse, because by mapping it on paper, and then reversing it on its straight edge, the whole ellipse became produced. As to the "Gest Tablet" see Appendix C.

Even if the contriver of this stone had no idea of the particular unit of measure by which it would as to its straight edge measure 9 (nine) of these particular units, viz: British inches, and its circumference 12 (twelve) thereof, especially when the power and convenience of these numbers for particular architectural purposes is considéred, it would seem impossible that he could have chanced on it. The fact that this unit of measure so fits in this exceedingly curious mode of making, showing and preserving a standard of measure is proof of the general intention of the contriver. Couple this fact with another, viz., that the mound in which it was found was an elliptical one "about 440 feet in circumference" a peculiar division of 5280 feet, (for $\frac{5280}{12}=440$) used much in Mound structure. Still further connect with these the further facts which we will show, viz.: that the use ofthis measure in the structure of the Mound Builder works, is confirmed in a great number of instances, nay universally; and that too, by an interchangeable play upon the numbers of the measures, as 12 and 21, 24 and 42, etc. Such being the condition of facts, and such is the condition of facts, one must seemingly come to the conclusion that the British inch and foot were used then just as one would have to now to recognize the measures and scale adopted in the construction of a multitude of rooms, passages, openings, etc., in any large and carefully constructed building of to-day.

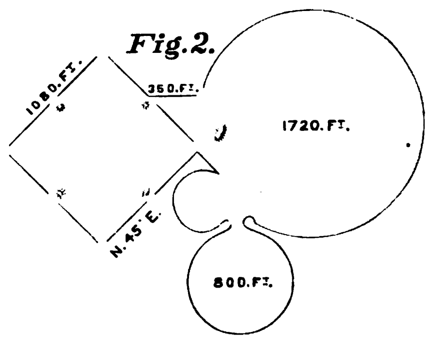
This stone was found and placed in the museum before many of the surveys of Squier and Davis were madeand before any of them were given to the public. They probably never heard of, certainly they have never mentioned the stone. Its appearance is not calculated to draw attention, and so far as we can discover has never been commented on by any one save Mr. Moore. Beyond the facts, that its shape was peculiar, that it was worked, and that it was found in the mound, there was nothing about it to attract more than a passing glance. It was deposited by M. Gridley in the museum at the request of Mr. Carley with some fragments of other pieces of stone found by Mr. Gridley, at the same time and place, and these are now in the collection of the Natural History Society, bearing the original labels.

To enforce what has been said as to the reliability of the reported measures of Messrs. Squier and Davis, a number of statements made by them in their work and bearing upon the matter, are quoted in Appendix B. They are of importance as a part of this paper, but are separated from the text that the actual measures of the works may stand out in clear relief. Premising that this inquiry is confined to what are denominated "The Sacred Enclosures," occupying the levels of the terraces as contra-distinguished from the "Fortifications," or military works, we will now proceed to the classification of the works, agreeably to certain prominent types of of measures used. It will be seen that all the various types of measure are inter-related, the one with the other. While this is of the gist of this paper, it will also serve as a remarkable support to the accuracy and faithfulness of the measures reported.

GROUP I.

This group comprises the use of two circles, a greater and a lesser, in combination with an especial square. This square is identically the same in quite a number of instances, the identity being originally and first discovered, as asserted by Messrs Squier and Davis, upon the compilation of work from the "Field Notes." The measure of the side of this typical square is 1080 feet. As an illustration, the plan of the works in Plate 20, page 56 of Squier and Davis surveys is given (Figure 2.) This work is situated in Ross County, Ohio, eight miles south-east of Chillicothe.

Fig. 2.



No. 1. The work just mentioned. As seen the side of the square is 1080 feet One circle has a diameter of 1720 feet, and and the other of 800 feet. An embankment connecting between the square and the circle will be noticed, 350 feet long. 350 feet

is 4200 inches, and one-fourth of this is 1050 inches This relation is significant, because the measure of 1050 feet is the second most conspicuous one in the mound works. So also, 350 is ther everse of 530, and 530 feet as will be seen is part of the side of a square forming the chord of a great circle, in the Hopeton Works.

No. 2. Plate 21, page 57, (we quote from Squier and Davis work,) gives *four* works, similar to No. 1, the square in each being 1080 feet to the side.

(a) A work on Paint Creek, a tributary to the Scioto river, 14 miles from Chillicothe,

(b) A work on "The Crossings of Paint Creek." The great circle is *about* 1687 feet in diameter, and contains an elliptical mound 140 feet long by 160 feet broad, and 30 feet high; also a small circle 250 feet in diameter. The length of the mound is to be noticed, for it is 1680 inches, a multiple of 42, which number divided by 4 is 105.

(c) A work on the Scioto river, 1 mile south of Chillicothe. The great circle of this work has a diameter of about 1625 feet.

(d) A work at Frankfort, or Old Chillicothe, on the left bank of the North Fork of Paint Creek. The great circle of this work is about 1625 feet in diameter.

In addition to the works mentioned, we have as especially setting forth the measure of 1080 feet:—

(1) The great square connected with the cone and ellipse, at Marietta, on the Muskingum river. This square measures 1080 feet to the side. Plate 26 page 73.

(2) The great rectangle at Winchester, Indiana. This rectangle measures upon one side 1080 feet, upon the other 1320 feet, or just one-fourth of a mile. If we add the length of these sides, we have 2400. The number 24 is constantly being used in the works in connection or contrast with 42 its inverse. $4\frac{1}{2}$ times 24 are 108, and 42 divided by 4 is 105. If we subtract 1080 from 1320 we have 240. Plate 33, page 93.

(c) The great rectangle at Hopeton, on the Scioto river, 4 miles above Chillicothe, connected with a great circle. One side of this rectangle is 10800 inches in length. The great circle is in diameter 1050 feet. Here the numbers 1050 and 1080 are brought immediately together.

(4) Two great rectangular enclosed parallels, each 750 feet long by 60 feet wide, or 9000 inches long, by 720 inches wide.

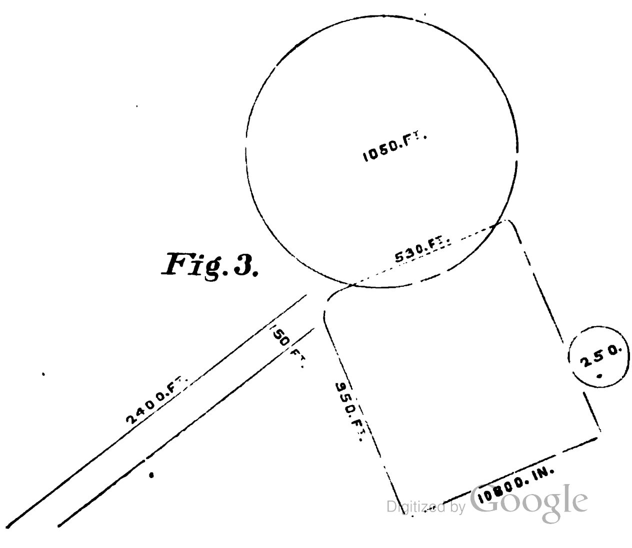
The area of each is 45000 square feet, or together 90000 square feet. This is 10000 times 1296 square inches.

It is noteworthy that the play of the numbers used about these works is the same that is so familiar with us, in our measures of space and time. 1296 square inches is one of our square yards, 4 of which, or 5184, multiplied by 1000 is the number of *thirds* in one solar day of 24 hours, measured on the circle of 360 degrees, as 15 degrees to the hour. That is, a circle of 360 degrees forming 24 hours, reduced to *minutes* and *seconds* and *thirds* gives 5184000‴ as parts It is the measure of time on such a circle that causes the transfer of the measure of right-lined shapes onto circular ones, by a fittingly chosen set of numbers, and the numbers 6, 12 and 36, have always, and with all nations, been used as the numbers for measures in common, for the two kinds of shapes, viz; rectangles and circles. 360×24 is 8640. The half of 864 is 432, and the play upon this number is common among the nations, as 324, 243, etc. 324 is 36×9, as also 108×3, while 1080 divided by 3 is 360. The illustration on Plate 24, page 66, given hereafter, gives this as an area, viz: 90 feet by 360 feet, or 32400, with 240 by 360 which gives 86400. The use is singularly that of the very ancient Babylonians.

GROUP II. A.

This group is characterized by a great circle, whose diameter is 1050 feet. The circle is connected with a rectangle. The illus-

Fig. 3.



tration is the plan of the Hopeton works, Ross Co., Ohio; situated on the east bank of the Scioto river, four miles above Chillicothe, Plate 17, page 51, of Squier and Davis.

No. 1. The Hopeton Works. The great circle is 1050 feet in diameter. One side of the rectangle is 900 feet in length, or 10800 inches. The combination with Group I is at once manifest. The side of the rectangle makes a chord of the circle 530 feet long. 900 less 530 is 370 feet. Five times 370 is 1850 feet, and 1850 less 900 feet, one side of the rectangle gives 950 feet, the other side of the same.

No. 2. The High Bank Works, on the Scioto river, five miles below Chillicothe, Plate 16, p. 50. Diameter of the great circle 1050 feet. This is connected with a great octagon 950 feet in diameter on a measured section.

No. 3. The Seal Township Works, near the Scioto river, in Pike County, Ohio, Plate 24, p. 66. Diameter of the great circle 1050 feet. The great circle is connected by parallels 475 feet long by 100 feet wide, to a square of 800 feet to the side. As to the parallel: 475 feet is 5700 inches, and 100 feet is 1200 inches. The area is 10,000 times 684 inches. 684 is but a play upon 648. Reduced one-half, 684 becomes 342, which number as said is remarkable in its various uses, as 243, 324, 432, and so on They are all multiples of 6, as $72\times6=432$. $54\times6=324$. $40.5\times6=243$ and $57\times6=342$.

GROUP II. B.

Related in measure, this same number 1050 is found in the following works:

No. 1. The Cedar Bank Works, Ross County, Ohio, near the Scioto river, five miles above Chillicothe; Plate 18, p. 52. They consist of a great rectangle, two and opposite sides of which measure, each, 1050 feet. The remaining sides measure 1400 feet each. At the centers of the sides of 1050 feet are entrances 60 feet wide. In the rectangle is a truncated rectangular pyramid, 250 feet long, by 150 feet broad, and 4 feet high, with graded ways leading on to it, 30 feet broad. Near the rectangle is an enclosed rectangular parallel, 870 by 70 feet. Near by is a group consisting of a square of 120 feet to the side, 9 feet high, and a circle 250 feet in diameter, having an entrance 30 feet in width. 250 feet less 30 is 220 feet, the characteristic measure of Group III.

1050 feet is 12,600 inches, the half of which is 6300. The number 63 feet is found on "*The Bird*" in the Newark Mounds and elsewhere. The third of 63 is 21, the inverse of 12, and $21\times5=105$, while $12\times9=108$.

No. 2. The Junction Group, Ross County, Ohio, on Paint Creek, two miles south-west of Chillicothe; Plate 22, page 61. This group, in the connection, is exceedingly noteworthy, as it shows a play upon the numbers 210 and 120, the sources respectively of 1050 and 1080. It consists chiefly of two circles which touch upon the opposite sides of a regular square, contained in a larger square, whose sides are much rounded, almost circular. One circle is 120 feet in diameter, the regular square is 120 feet to the side, surrounded by a bank whose shape partakes of the nature of a square and a circle. The circle upon the opposite side is 210 feet in diameter, or 105×2 feet; hence the unit of measure is 105 feet. Near this last is another circle 210 feet in diameter. Off to one side, at some distance is a regular square of 160 feet to the side, in a very symmetrical figure, 240 feet across, with sides much rounded, and which partakes of the shape of the circle and the square.

No. 3. The remarkable "Graded Way," near Piketon, Pike Co., Ohio; Plate 31, p. 88. The measures of the "way," combine in a special manner, those of Groups I and II. One section of this "way" is 1080 feet long. From this proceeds an embankment 1500 feet long, at the end of which a bank runs off at a slight angle, a length of 420 feet. In the side of the long line, and at right-angles to it a bank projects 212 feet, then an elbow runs parallel with the main line 420 feet, and from the extremity of this last, diverging from it at a slight angle, a bank runs in towards the main line a distance of 240 feet. Here is unmistakable evidence of the purposed combination of the characteristic measures 1050 and 1080 feet, of Groups I and II. 24 feet is 6×4, while 42 feet is 6×7. The fourth part of 4200 is 1050, while $180\times6=1080$ feet. So, also, $212\times2.5=530$, the chord of the circle in the Hopeton Works, where 1080 is directly connected with 1050.

No. 4. The Portsmouth Works in Kentucky, opposite to the old mouth of the Scioto river; Plate 28, p. 78. This work consists of two ways, or parallels, each 2100 by 210 feet, converging from opposite directions on a square of 800 feet to the side. The unit of measure is evidently 105 feet; or 21 as the inverse of 12.

So 105 feet is 1260 inches, and the number 126 is quite a famous one among the ancients, especially in Hebrew Caballah.

The fact is, these relations of measures so pervade the entire aggregate of the surveys in the work of Squier and Davis, that it would be tiresome, and really unnecessary to repeat almost all their labors simply to force attention by mere accumulation.

GROUP III.

This group is characterized by the use of the number 110, in combination with 1080 of Group I.

The number 110 is derived from the number 5280, which *in feet*, is one mile in our measure. The divisions of this number give the controlling measures of this group. The number 24 and its inverse 42, gives rise to the numbers as measures, controlling the construction of the works in Groups I and II; and 5280 divided by 24 is 220, and the half of this is 110, which with its multiples make the prominent measures in this group.

The illustration, "Figure 4," is the rectangular ancient work near Winchester, Randolph Co., Indiana; Plate 33, p. 93.

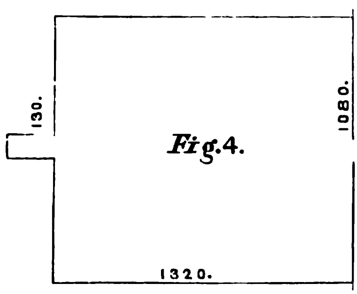


Fig. 4.

No. 1. This rectangle at Winchester. It is 1320 feet in length, on one side, by 1080 feet upon the other. 1320 feet is one-fourth of one mile. 1080 feet as a measure, characterizes the works in Group I. $1320+1080=2400$ feet. In the Newark elliptical work, the number 2400 feet is divided into 1250 and 1150 feet, to make the conjugate diameters. 1320 less 1080 shows the lack to make an exact square. The difference is 240 feet. 1320 is 12 times 110.

No. 2. Rectangle shown in Plate 32, p. 91. It is 220 feet long, by 120 feet broad. $220\times120=26400$, or 13200×2.

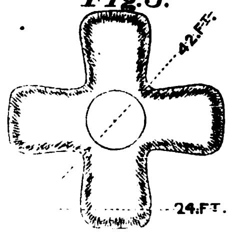
No. 3. Rectangle shown in Plate 29, p. 82. It is 550 feet long, by 630 feet broad. 550 is 10 times 5280 divided by 96. The difference between 630 and 550 is 80 feet, or 960 inches, in the digits of which number we have the divisor of 5280 to give the number 550.

No. 4. Plate 28, p. 78. The work is an oval 110 feet long, by 60 broad (the plans say 70, letter press 60). On the same plate is shown a mound 110 feet in diameter at its base.

No. 5. Plate 23, p. 63. This is a group of 7 circles. Three have a diameter, each, of 130 feet, one of 200 feet, one of 210 feet, and two of 110 feet, each.

No. 6. Plate 36, p. 98. The work is called in the text "The Greek Cross," and is given "Figure 5" because of a remarkable

Fig. 5.



combination of the numbers 42, 24 and 12, and because the foregoing will almost justify the statement that a connection is intended to be shown with the number 1320 feet. The length of the Cross is 90 feet, or 1080 inches. The width of the end of the arm is 24 feet, while the diagonal of the body, is 42 feet, one-fourth of which is 10.5 feet. The circle in the center is 10 feet or 120 inches in diameter. But what is peculiar in this connection is, that if 42 be taken as the diameter of a circle, then the addition of less than $\frac{3}{100}$ of a foot, will give a circumference of 132 feet for the circle, which is the tenth part of one quarter of a mile. Of course speculation is not allowable in a research of this kind, which is simply to tabulate measures given; yet from the lesson of these three groups of measures, it becomes easy to imagine that this number 42, was intended to suggest connected relations of the three groups in one figure. This work is 3 feet, or 36 inches high.

With very few exceptions these three groups of measures are involved in some way, in all the surveyed works of the ancient "Sacred Enclosures," given by Messrs. Squier and Davis. The

groupings themselves, show, by the extraordinary variety, yet perfect dependence, or rather inter-relation, the one upon or with the other, that the surveys *were actual*, and the measures correct as reported. The impression produced by the investigation of the reported measures of these works, is almost irresistable that they are constructions of to-day, made by use of our standard measures, in the familiar denominations thereof. So strong is this impression that unless fortified by proof made positive, it would appear that no reasonable man can believe that the exact measures were correctly reported by Mr. Charles Whittlesey, and by Messrs. Squier and Davis; and this even in the face of the high standing of these gentlemen, and their reiterated averments that their measures were carefully and minutely taken "with compass, line and rule," and were reliable.

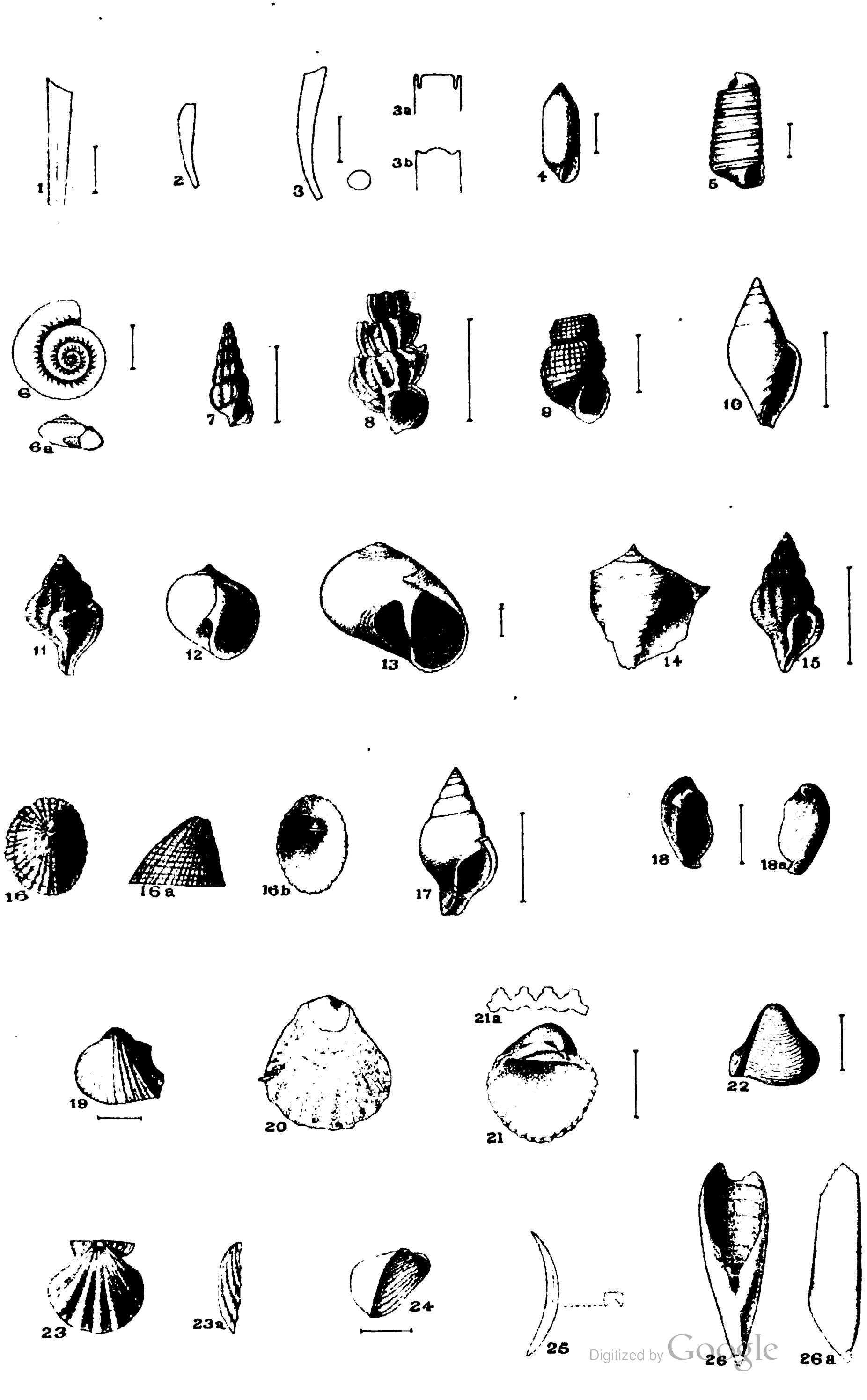
I have tried as far as possible to make their own assertion as to their measures good, by intrinsic evidence, and judge that this has been done; for certainly no one could suspect them of purposely making so elaborate and coherent a system of interrelated measures, either when taking the surveys, or as an after-thought, when the "field notes" were brought together. It would have been preposterous for them to have attempted such a thing; nor had they tried, could they, unless by notable perversions, and with very great labor and ingenuity, have fabricated with a different set of measures than used by the Builders, a fraud which would have borne the test of such an analysis as the above.

The discovery of a unit of measure, which exactly fits to the construction of all these works, showing so perfect a system, *as reported*, was the one thing wanting to justify the measures themselves as being rightly taken, and perfectly satisfy the most skeptical. This discovery was made, as already stated, by Mr. R. B. Moore, in the elliptical stone in the treasures of the Natural History Society. It is simply our "*two foot*" rule over again, but connected with another unit of measure, which we do not possess, viz, that of 9 inches. 9×12 inches $=108$ inches, $12 \times \frac{7}{8} = 10.5$, or $9+12$ divided by 2 equals 10.5 inches, while $12 \times 44 = 528$ inches. The application of these very simple grades of measure explains the base of the construction of all the ancient "Sacred Enclosures" of the Ohio Valley. Dr. Drake reported the measure of the elliptical mound in which the measuring stone was found, as about 440 feet in circumference.

(TO BE CONTINUED.)

PLATE II.

Fig. 1, Dentalium incisissimum, n. sp.
Fig. 2, Cadulus abruptus, n. sp.
Fig. 3, 3*a*, 3*b*, Cadulus, sp.
Fig. 4, Cylichna volutata, n. sp.
Fig. 5, Cerithiopsis quadristriaris, n. sp.
Fig. 6, 6*a*, Solarium elegans, Lea var , modestum, n. var.
Fig. 7, Scalaria (Opalia) albitesta, n. sp.
Fig. 8, Scalaria Newtonensis, n. sp.
Fig. 9, Eglisia retisculpta, n. sp.
Fig. 10, Marginella constrictoides, n. sp.
Fig. 11, Fusus Newtonensis, n. sp.
Fig. 12, Natica Newtonensis, n. sp.
Fig. 13, Sigaretus (Sigatica) Boettgeri, n. subgen, et. n. sp.
Fig. 14, Cassidaria planotecta, n. sp.
Fig. 15, Murex cancellaroides, n. sp.
Fig. 16, 16*a*, 16*b*, Fissurella altior, n. sp.
Fig. 17, Columbella mississippiensis, n. sp.
Fig. 18, 18*a*, Sigaretus inconstans, n. sp.
Fig. 19, Neæra (Cardiomya) multiornata, n. sp.
Fig. 20, Plicatula planata, n. sp.
Fig. 21, 21*a*, Venericardia complexicosta, n. sp.
Fig. 22, Corbula Murchisoni, Lea var., fossata, n. var.
Fig. 23, 23*a*, Tecten pulchricosta, n. sp.
Fig. 24, Xylophaga ? mississippiensis, n. sp.
Fig. 25, Scalpellum subquadratum, n. sp.
Fig. 26, 26*a*, Belemnosis Americana, n. sp.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Vol. IX. No. 3.

THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee:

GEO. W. HARPER. WM. HUBBELL FISHER.
TRUMAN H. ALDRICH. THOS. FRENCH, Jr.
DAVIS L. JAMES.

OCTOBER, 1886.

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CALENDAR OF MEETINGS

6

THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. IX. CINCINNATI, OCTOBER 1886. No. 3.

PROCEEDINGS CINCINNATI SOCIETY OF NATURAL HISTORY.

June 16, 1886.

Special meeting under the direction of the Lecture Committee to hear papers on the Destruction of Native Birds.

Vice-President Skinner occupied the chair. Papers were read by Messrs. Chas. Dury and Wm. Hubbell Fisher, and Prof. Jos. F. James replying to Dr. Langdon's remarks at the regular meeting of June 1st.; Dr. Langdon followed with remarks and Messrs. Dury and Fisher responded.

After a prolonged discussion the meeting adjourned at about 11 p. m.

BUSINESS MEETING, *Tuesday, July* 6, 1886.

President Dun in the Chair. Sixteen members present.

The reading of the minutes of Executive Board was dispensed with.

H. F. Farny and Prof. T. H. Norton were proposed for active membership. Prof. R. W. McFarlane, of Oxford, Ohio, was recommended for honorary membership by the Executive Board.

Messrs. H. P. Piper and H. M. Brown were elected active members.

The Committee on the Destruction of Native Birds submitted the following report:

To the Cincinnati Society of Natural History:

Your Committee report that they have carefully investigated the subject of the *Destruction of our Native Birds.* Several papers

have been prepared and read at three meetings of this society. They find

First—That native birds of many species have greatly decreased in numbers over large areas of the country. This is particularly true of those water and game birds about which it is comparatively easy to obtain statistics.

Second—That the chief causes of such decrease, in addition to climatic changes, natural enemies, clearing up the country, etc. are

1—The destruction of birds for their skins and feathers, for decoration and millinery uses.

2—The trapping of birds for cages.

3—The destruction of eggs and nests by men and boys.

4—The introduction of the European sparrow (Passer domesticus), which occupies the nesting places of many native species.

Three of the destructive causes are preventable and the evils resulting therefrom can be greatly lessened:

First—If no birds be used for decoration.

Second—If none of the song birds and insectivorous species be used for food.

Third—If the laws protecting certain species be backed by stronger public opinion and more rigidly enforced.

Fourth—If thoughtless men and boys could be shown the great economic value of birds and taught to protect them and their eggs.

Your Committee think a wide spread discussion of this bird question shows more interest in "Our Feathered Friends" than was hoped for, and they trust that Cuvier Clubs, Audubon Societies and and other clubs of like aims, will continue to flourish on all sides until public sentiment and practice is entirely opposed to the Destruction of our Native Birds.

Respectfully submitted,

R. H. WARDER,
CHARLES DURY,
WM. HUBBELL FISHER.

CINCINNATI, O.,
July 6, 1886.

It was moved that the report be received and the Committee continued.

Dr. F. W. Langdon said:

Mr. President—It is fully understood, I trust, that in the discussion on birds, which has occupied your attention for several meetings past, only the kindliest personal feelings exist between my ornithological friends and myself. Any criticisms of your Committee by myself are to be taken, of course, in strictly an official, not a personal, sense.

The discussion has been conducted purely in the interests of the Cincinnati Society of Natural History, with a view to awakening public interest in the subject and in the society. That it has been a success in these respects, I think you are all aware. I beg leave to object to the adoption of the final report of your Committee as read to-night, on the following grounds:

First—That it entirely evades the main question at issue, viz., "the destruction of North American *song* birds for millinery purposes."

Secondly—It inferentially supports the proposition that "song birds" are habitually and commonly used for food, when such is the case in only limited localities.

Thirdly—It inferentially expresses the opinion that sportmen's clubs and "Audubon Societies" are "*entirely*" opposed to the destruction of native birds, which is notoriously not the case.

Fourthly—It aims at the impracticable when it seeks to create a "public sentiment *entirely* opposed to the destruction of our native birds." This would be a death blow to the progress of ornithological science; would conflict with the interests of all sportsmen and sportsmen's clubs; draws no distinction between desirable and undesirable birds, and would be as irrational as to *entirely* oppose the destruction of mammals, reptiles, fishes or plants.

Fifthly—While the report of your Committee states as a self-evident fact that water and game birds have markedly decreased over wide areas, it ignores the undoubted increase over those same areas of the smaller and more useful species to man, viz.: song birds and insectivorous species generally.

Sixthly—The report of your Committee, viewing the subject from one side only, arraigns man for his *destruction* of birds, while it fails entirely to give him any credit for his *constructive* influence, which has been repeatedly emphasized in the course of the discussion.

Finally—I would caution the society, as a scientific body, against hastily committing itself to a one-sided view of an important question, on insufficient evidence and with but a handful of members present; and it would urge those members present to think twice before putting the society on record as a body swayed by sympathy and prejudice rather than by facts, reason and judgment.

Mr. R. H. Warder said that Dr. Langdon, in his papers, confined his remarks to song birds, whereas the report of the Committee referred to *all* native birds. The original resolution should have read "Our *Native* Birds," not "*Song* Birds."

Dr. Langdon said he did not confine his remarks to song birds. He thought man's protective as well as his destructive powers should be recognized.

Mr. Fisher remarked that Dr. Langdon's statement that the whole movement is a shrewd advertising scheme of an enterprising Eastern journal, is not just, any more than a charge that the New York World's advocacy of the Fresh Air Fund is an advertisement for that paper. The Audubon Society, a branch of the American Ornithologists Union, is disinterested in its work. All means possible should be and are being used to bind up a public sentiment against the destruction of birds. The object of the Committee has been to encourage such a sentiment, and to enforce the laws protecting birds.

Mrs. Jos. F. James thought that Dr. Langdon's papers had been an injury to the cause. Persons had refused to sign the pledges, quoting Dr. Langdon as authority for the belief that birds are in no danger of extermination.

Dr. Langdon said in reply that his papers had stirred up an interest in the subject, and if members were joining the Audubon Society at the rate of 1000 per day, as he had heard, he thought no harm had been done.

Mr. Warder, on behalf of the Committee, desired to make the report final.

Mrs. James moved its adoption, seconded.

Dr. Langdon objected.

The motion was carried.

Prof. Jos. F. James read a paper, by title, on the Geology and Topography of Cincinnati, being the conclusion of a paper read at the previous meeting.

The Society, by a special vote, requested the paper to be read in full at the meeting in August.

Messrs. Dury and Langdon requested that facts and short articles for a Zoological Miscellany for the Journal be sent in.

Donations were announced as follows, and the Society adjourned .

From Bureau of Education, Circular of Information, No. 5, 1885; from Forum Publishing Co., "The Forum," vol. 1, No. 1; from Publishers, "American Sportsman," June 19, 1886; from Chief Signal Officer, Monthly Weather Review for April; from Director of Geol. Survey of India, Records of Geol. Survey of India, vol. 19, Part 2; from Jos. F. James, the "Weather Journal," Nos. 1, 3, 4, 5, 6; from Carlos Shepard, Bone and Pottery from mouth of East Fork, L. M. R., Flints from same, Spear Point from Clermont Co., O.; from Dr. O. D. Norton, Seeds of Sorghum vulgare, Oriza sativa, Melia Azederach; from Wm. H. Knight, Flammàrion's "Wonders of the Heavens"; from U. S. Fish Commissioner, Bulletin of U. S. F. C., vol. 6, Nos. 4 to 8; H. H. G. Smith, specimen of Cecropia Moth; from F. W. Langdon, M. D. specimen of Trox sp.; from Mrs. Wm. Andrews, Twelve Volumes of Books; from U. S. Geol. Survey, Monographs, vol. 9; from Geo. S. Huntington, Star Fish and Echinoderms from Florida, one Trunk Fish.

Adjourned.

SCIENTIFIC MEETING, *Tuesday, August* 3, 1886.

President Dun in the chair. Twenty members present.

Prof. Jos. F. James read his paper on the "Topography of Cincinnati," presented by title at the July meeting.

Mr. Wm. H, Knight read a paper on "Photographing the Stars; recent discoveries in the Plieades."

Dr. Dun calling Prof. James to the platform presented, with appropriate remarks, an engrossed copy of the following "Testimonial":

"This Testimonial is presented to Prof. Jos. F. James by the Cincinnati Society of Natural History, on his resignation of the position of Custodian, which office he has efficiently and faithfully occupied from 1881 to 1886—always conscientiously attending to his multiform duties, furthering the interests of the society and gaining the good-will of the members by his agreeable demeanor and his uniform willingness to oblige. He takes with him to his new sphere of usefulness as Professor of Botany and Geology at the Miami

University the esteem and best wishes of the members and officers.

(Signed by the officers of the Society and members of the Executive Board.)

Prof. James responded thanking the Society for the token of esteem and bespoke for his successor the same kindness and sympathy in his work that had been accorded to him.

Prof. Mickleborough, of Brooklyn, N.Y., who was present, by request, addressed the Society, congratulating it upon the work accomplished during the past two or three years.

Mr. Wm. Hubbell Fisher presented the following resolution:

"Resolved: that the Cincinnati Society of Natural History fully and heartily endorse the statements and sentiments of the President's address and those of the "memorial" presented to Prof. Jos. F. James."

Upon motion, duly seconded, the resolution was unanimously adopted.

Miss Lizzie Laws, Miss Annie Laws and Mr. A. C. Siewers were proposed for members, and Messrs. H. F. Farny and T. H. Norton elected to active membership.

Prof. Jos. F. James offered his resignation as Librarian.

The resignation was accepted and the election of a successor ordered for the next meeting.

Dr. Dun then presented to the Society the newly elected Custodian, Mr. Horace P. Smith.

Donations were announced as follows: From Mrs. Mary Stubbs, seeds and pods of Sweet Gum; from R. H. Warder, Volume of Essays and Addresses by John H. Warder; from Prof. Geo. W. Harper, steel plate Portrait; from R. O. Collis, Trays of animal bones from Madisonville; from A. E. Heighway, M. D, specimen of Canada Porcupine; from T. J. McAvoy, specimens of Snake, Frogs, and Bat, specimen of Tetradium fibratum; from G. H. Curtis, one slide of Diatoms; from Zoological Garden, skin and skull of Oppossum; from T. P. Gore, Specimen showing union of saplings; from Chief Signal Officer, U. S. A., "Monthly Weather Review"; from Mrs. R. W. Summers, Herbarium specimens; from Geo. C. James, specimens of Lignum-vitæ; from Dr. O. D. Norton, skin of Rocky Mountain Lion, specimen of Tin Ore; from Alex. Starbuck, eighty specimens of Bird Skins.

TUESDAY EVENING, *Sept.* 6, 1886.

SCIENTIFIC MEETING.

President Dun presiding. Sixteen members present.

Dr. Langdon presented remarks upon the Birds of the Chilhowee range of the Great Smoky Mountains of Tennessee.

Prof. Jos. F. James read, by title, a paper of the "Sponges of the Cincinnati Group."

Prof. James also read an extract from a letter from Prof. J. S. Newberry, saying that he had matter in hand regarding New Fishes from the Devonian Rocks of Ohio, and asking if the Society would be willing to publish it.

Dr. Newberry was, by motion, seconded and carried, invited to read a paper on the Devonian Fishes of Ohio.

Dr. Heighway spoke upon the late meeting of the American Association for the Advancement of Science at Buffalo.

Members were elected as follows: Misses Lizzie and Annie Laws, and Mr. A. C. Seiwers, and the following persons proposed for active membership: Dr. John D. Jones, Mr. Horace P. Smith, Mr. Theo. P. Anderson, Jr., Miss Emily Hopkins, Miss Mollie Gohegan.

Prof. Geo. W. Harper was elected Librarian to succeed Prof. James, resigned.

The Curator of Botany, Miss Nettie Fillmore, announced that the section of Botany would resume its weekly meetings, beginning September 11th, at 2 p. m.

The President called the attention of members to a set of the Publications of the Geological Survey of India lately received in exchange.

Adjourned.

Donations were received during the month as follows: From Dr. W. A. Dun, indian relics, bird skulls, ears of rabbit, specimen of Agate; from Mr. Bryant, crystal of Beryl, shells of Anodonta dicora; from Dr. O. D. Norton, specimens of Syenite, "Histoire Naturelle des Oiseaux ornee," Albin 1750; from Dr. W. A. Dun, lantern slides, fragments of ancient pottery, arrow points, specimens of Lava, Pyrites, bronze medal, mosaic from Venice, specimen of silver ore; from Miss Magurk, impressions of coal plants, herbarium specimens from Lookout Mt.; from Jos. F. James, pamphlets; from Al. Gahr, specimen of iron ore, fragments of pottery, flints; from Baron Felix von Thumen, Monograph, "Der Reben Mehl-thau."

THE GEOLOGY AND TOPOGRAPHY OF CINCINNATI.

By Prof. Jos. F. James,

Custodian of Cincinnati Society Natural History.

Part II.

TOPOGRAPHY.

(Read August 3rd, 1886.)

Turning from the Geology to the Topography of the City, we find many interesting features developed. The so-called hills, which rise to the north, are of heights varying from three hundred and ninety-six feet above low water, the stated height of Mt. Adams, equal to eight hundred and twenty-eight feet above the sea, to four hundred and sixty feet given for Mt. Auburn, or eight hundred and ninety-one feet above the sea.

It is almost impossible to conceive a correct idea of the appearance of the site of Cincinnati before it became a city. The pictures we have, which pretend to show its appearance in 1802, or fourteen years after its first settlement, represent the two terraces to be nearly bare of trees, a few clumps appearing here and there only, but the hills and valleys to the north are represented as densely clothed with forest trees. They recede from the river to the westward, and in one view six elevations are shown with depressions between them. These hills, as we may for convenience call them, were originally rounded on top, and with sloping sides, but are now so cut away and seared with streets as to have lost much of their original form.

There still remain, however, the great drainage valleys which have, for ages, carried the water from the north, south into the Ohio river. None of them, except Mill Creek, which, as shown in the first part of this paper, now occupies part of the ancient channel of the Ohio, are of any great extent, and this is one fact tending to prove the former insular character of the suburban parts of Cincinnati. The most eastern one of these valleys emptying into the Ohio is Crawfish Creek. This divides Mt. Lookout from Walnut Hills, forming a broad plain at its mouth, always overflowed by high water in the Ohio, and it heads up several miles in the country, now covered by part of East Walnut Hills.

The next valley to the west is Deer Creek, and this separates Mt. Adams from Mt. Auburn, and is of less extent than the first one. For the extreme northern end of this valley is south of Oak Street, Mt. Auburn, less than two miles from the river, and it here meets a ridge which divides it from a valley draining to the northward.

The third of these valleys is that between Mt. Auburn and Clifton Heights, and is even shorter than the second one, finding its head, also, at the ridge before spoken of.

Still further west is a yet shorter but steep valley, and then there are no others until the broad valley of Mill Creek is reached, and this is bounded on the other side by the long range of which Mt. Harrison is a part.

While all these valleys and their attendant heights have added greatly to the picturesqueness of the city, they have, at the same time, been taken advantage of in the building up of the suburbs. The heights have been utilized for dwellings, while the valleys between have proved invaluable for streets. Mt. Tusculum, Mt. Lookout, Mt. Adams, are all dotted with residences. Walnut Hills has become a city in itself, in many places as compactly and solidly built up as the business centre; while Crawfish and Deer Creeks have been found of the greatest service in giving access to the country on either side, and to the northward. Mt. Auburn and Clifton Heights each occupy a peculiar position on a long, narrow tongue of land projecting southward and ending in abrupt precipitous banks, to ascend which steam has been evoked. Both ridges are so narrow as to admit of but one street and a row of houses on each side. Back of the houses the ground slopes rapidly down into the ravines, and this narrow space has been the cause of the stationary condition of these two suburbs, while Walnut Hills has gone on so rapidly expanding.

The two tongues of land are similar in another respect, for while they both jut southward and end abruptly, their northern ends abut against an east and west ridge which forms a connecting link between the most western limit on Mill Creek and East Walnut Hills. This ridge forms indeed the water shed, the divide between the drainage directly into the Ohio river, to the southward, and the round about passage into Mill Creek, to the northward. The village of Avondale lies on the north side of this ridge, and thus can by no possibility drain its sewage into the Ohio river except through the medium of Mill Creek or Duck Creek.

While the ridges have, as shown, been utilized for the purposes of residences, the valleys have been equally serviceable for streets and roads. Crawfish Creek, for example, is used not only by a wagon road, but by the Mt. Lookout Dummy Railroad. Deer Creek valley serves for the Northern Narrow Gauge, Hunt street and Gilbert Avenue. The ravine between Mt. Auburn and Clifton Heights serves Vine Street an excellent purpose, in climbing to the top, by a long, gradual slope. The ravine next west is used by Clifton Avenue, while the great Mill Creek valley is of incalculable advantage to numerous railroads and the Miami Canal, enabling these to reach the heart of the city with no grades of any consequence whatever.

The tracing of the divide, which separates the Ohio river drainage from that of Mill Creek, is an interesting matter. Investigation shows it pursues a general north-east and south-west direction, and for part of its course can still, with all the changes attendant upon the building of a large city, be followed in quite a definite manner. Beginning at the extreme southwest end, at a point overlooking Mill Creek, we find it follows a line to the northeast, and touches the western end of Calhoun street in Clifton Heights. It then turns east and follows a little to the south of Calhoun, across to Mt. Auburn, and forms the ridge which has already been referred to, as the north end of the spurs, occupied by Ohio and Auburn Avenues. Just where Calhoun street and Ohio Avenue come together there is a deep ravine, trending to the south, through which the water is carried to the Ohio river, and up the lower part of which Vine street has been built. On the north side of Calhoun is another deep ravine, which trends northward, finally forming part of Burnet Woods Park, and carrying other water into Mill Creek somewhere near Ross Lake. Calhoun street is, in most places, just wide enough for the road-way and houses on each side, and back of the houses the ground slopes rapidly north and south. Following the divide, as it is now plainly seen to be, to the eastward, we find that the Mt. Auburn water tanks, on Auburn Avenue, stand upon it, that Auburn street follows its winding course, and is of the same character as Calhoun street, namely, just wide enough for the road-way and houses on each side. When Highland Avenue is reached the divide trends northeast again, and upon its highest point is situated the house of John Shillito. Thence it follows Oak street to the Reading road,

crossing this, and taking a southeast course toward Crown street, and then diagonally southeast to Macmillan. Along Macmillan to Gilbert Avenue seems next its course, and then from the junction of these two streets it goes diagonally to the bluff, south of Macmillan street, and immediately over-hanging the river. Here it ends abruptly, and all the drainage of East Walnut Hills is carried east and north into ravines running into Crawfish and Duck Creeks, and far north into Mill Creek.

The peculiar features of ravines, heading up on both the south and the north sides of the divide, reminds one of the remarks of Capt. Dutton, quoted in part one of this paper, that in mountainous countries the ravines form a series of amphitheatres close to a narrow divide which remains sharp in all stages of erosion. We find this to be exactly the state of affairs on Calhoun and Auburn streets, for there, on both north and south sides, the heads of ravines come up close to the narrow knife-like water shed.

While the Mt. Auburn and Ohio Avenue ridges project to the southward of the divide, there are others of a similar character on the north. One of these runs in a long, beautifully gentle slope through the western side of Burnet Woods Park, and the other is utilized by upper Vine street and Ludlow Avenue. The two latter form the main streets of Corryville, and if the former ridge were not a portion of Burnet Woods, there is no reason why it should not have built upon it a new suburb equal, if not superior, in beauty, to Clifton Heights and Mt. Auburn.

Walnut Hills, on the contrary, occupies no such pronounced tongue of land, but covers, with its fine residences, a vast undulating tract, the most level of all that remains of the plateau which once existed. Avondale, too, occupies a similar rolling tract of country, and is also situated on the northern slope of the divide, so that all its drainage flows into Mill Creek to the northward, though eventually into the Ohio.

On the east side of Avondale, beginning about half a mile from Macneale Avenue, is one of the most beautiful valleys in the neighborhood of the city. At its upper or southern end it is rather narrow, and through its centre wanders a small brook. As we go down the valley widens and deepens. The little brook becomes larger and cuts deep into the rich soil, and the green hill-sides rise on either hand with few or no trees. Toward the lower end trees become more abundant, but in no case do they form a thick

growth, and there is no appearance of their ever having done so. In one place where a lateral ravine comes into this wide one are several granitic boulders, evident waifs from some far away source, probably deposited by an ancient glacier which had here stopped and melted.

On the northwest side of Avondale is another deep ravine still covered with the original forest, and deep down in its shady recesses meanders a little brook which carries away the surplus water to its final resting place, Mill Creek. This ravine, unlike the first one, is still clothed with the primeval forest, and huge giants some of the trees are. This is a favorite picnicing place, and here too, children and their elders go in spring to gather wild flowers. The Carthage Pike crosses this ravine near its lower end, where it has lost all its forest beauty from having been used for so many years as part of a dairy farm.

The Rev. G. F. Wright, of Oberlin College, Ohio, after making an exhaustive study of the glaciated surface in Pennsylvania, Ohio and Indiana, found that the southern foot of the continental glacier crossed the Ohio river somewhere near Point Pleasant, about twenty-five miles above the city, and extended a short distance into Kentucky, recrossing the Ohio at Aurora, Indiana, and thus blocked the course of the stream for about fifty miles.*

In commenting upon this circumstance another writer, Prof. I. C. White, estimates the height of this glacial dam at 645 feet above low water in the Ohio river at Cincinnati.† Now the highest land at present about our city is 460 feet above low water mark. I have examined many places on the tops of the hills in this city, and on none of them have I seen any traces of glacial drift. The bedded rocks are close to the surface, and only have on top of them such soil as would have been naturally formed by the disintegration of the rocks themselves. That there is glacial drift near the bases of the hills and in the valleys can not be denied, for the evidence is everywhere abundant, but that it ever existed on top of the highest ground about this city, I do not think can be proved. It therefore remains a question whether the icy barrier could have reached any such height as six hundred and forty-five feet above low water, and thus covered the highest ground with a mass of debris of which no trace remains.

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*Abstract in Pro. Am. Asso. Adv. Sci., vol. XXXII., p. 207.—See also Ohio Geol. Vol. V., p. 750, *et seq.*

†Ibid, p. 213.

From all the facts given in this paper, it is easy to see the interesting features of our city's surroundings. The broad, deep stream of the Ohio, which, passing our city in a graceful curve, gives life to many thousand square miles of country, the two gravel terraces, the wonderfully carved plateau, with its diversified aspect of valley and ridge, its deep ravines and its gentle slopes, together with its vast store of fossil remains, famous the world over, these are its attractions. Nor is this all, for, situated on part of the oldest dry land in the Western World, its site can boast an antiquity which puts to shame many more renowned cities. And while New Orleans has been founded upon a soil which is yet saturated with its baptismal shower, Cincinnati has planted herself on rocks hoary with the age of countless centuries; rocks which form the everlasting hills; rocks which were gray with moss when the site of Louisville was fathoms deep beneath the ocean waves; when that of St. Louis was as yet scarcely even in the process of formation; long before even the grandeur of the Rocky Mountains was revealed to the wondering vault of heaven, or the Mississippi babbled a tiny brooklet among the Archean Mountains of the far north. Thus we can boast an antiquity far greater than many other American cities. And, though the settlement made by man has not yet attained to its hundred years, its foundations date far back into the earliest history of the earth; to a time, compared with which the epoch of man himself, upon our rolling globe, is but the fragment of a minute in the long roll of countless centuries.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Paper contributed by J. Ralston Skinner, Dec. 1, 1886.

(Continued from page 127.)

Group IV.

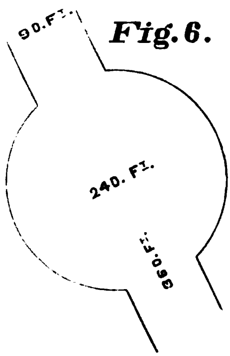
Can we not admit, then, as established, that the Mound Builders possessed a standard unit of measure, which is to-day known and used as our British inch? If so, they possessed a standard of 12 of these inches, combined on the same tablet with one of 9 inches, the tablet being of such a form that the 12 implied the use of 24 inches. This arises from the natural suggestion of completing the ellipse by doubling the curvature of the elliptical measuring stone or tablet. In making use of their tablet we find that they applied the same numbers interchangeably as designative of sides of squares, of rectangles, of lengths of long parallel ways, and as connected with circles (and ellipses), both to measure diameter and circumference lines. Indeed, the relation of square to circle, in terms, for measure of the general constructive numbers, or simpler, in terms of the number 6 and its multiples, is everywhere beyond contradiction manifest.

From this it becomes safe to say that this mode of construction rested upon a knowledge of the relation of a right line to the curved one of the circle, or of diameter to circumference of the circle; and consequently of the relations of circular and rectangular areas. The Mound Builders knew of the geometrical relations of these shapes, of their numerical ratios, and had the peculiar standard of measure mentioned to exhibit the numerical relations by application to the shapes themselves. We will try and show this from the works.

The exception is so rare to the use of the multiple of 6 feet, or to the numbers 210, 120, 420, 240, 1,080, 1,050, and the divisions of 5,280, that when found it is worthy of especial attention. Such an exception does take place as to the measures of one great and distinctive work, and one of the groups of works of the Scioto Valley, near Chillicothe. But while it is such an exception, nevertheless we do find its remarkable measures connected with *the combination* of the most prominent measures of the groups, viz., 1,080

and 1,050, so as to show the numerical relation of diameter to circumference of a circle. We will show this, but will first set forth one work, which directly and significantly shows the knowledge of the circle of 360, connected with the measure of 240 and 90 feet, or 1,080 inches. This work is part of the Seal Township Group, in Pike County, Ohio, near the Scioto river, Plate 24, p. 66. In this group are some of the most perfect figures of the circle inclosing a square, the diameter of the circle being 300 feet, and the side of the interior square 125 feet, and of the ellipse. As to the circle and square the Authors say: "Nothing can surpass its symmetry," and further: "It will be remarked that we have here, the square, the circle and the ellipse, separate and in combination,—all of them constructed with geometric accuracy." As to the work to be shown, "Figure VI," they say: "its outlines beautifully distinct;" and they conclude: "It is impossible to resist the conviction that some significance attaches to these singular forms."

Fig. 6.



Here, in Figure VI, we have the circle of 240 feet in diameter. $240\times\frac{35}{8}=1050$. The width of the passage way through the circle is 90 feet, or 1080 inches, 1080 divided by 3 is 360, and the length of the passage way is 360 feet. This is 4320 inches. The length of each arm of the passage-way is 60 feet, or 360 inches, multiplied by 2, 360 less 120 is 240 feet, the diameter of the circle, or 2880 inches, the circumference, in feet, of the famous Newark circle, which will be given in its place. 4320 less 2880 is 1440, 144 being the square of 12. $432\times.75=324$, twice which is 648. These two numbers viz.: 432 and 324, were especially used with

the Chaldeans and ancient Babylonians, or pre-Semites With the Chaldeans, from the beginning to the deluge, was 120 *sari* of 360 years each, or 43,200 years. In the very most ancient Babylonian account of the flood, taken by George Smith, from the cuneiform tablets of Nineveh, the use of this number with 1080 and 360 is made so as to bring out a play upon these numbers, 432 and 324. Khasisatra is relating to Ishdābar (Semitic compound word, meaning "*Man-Word*") the events of the deluge. He says, in regard to constructing the Ark, and furnishing it: "I poured on to the exterior 3 times 3600 (10800) measures of asphalt, and 3 times 3600 (10800) measures of asphalt within. 3 times 3600 (10800) men, porters, brought on their heads the chests of provision. I kept 3600 chests for the nourishment of my family, and the mariners divided among themselves 2 times 3600 (7200) chests," that is, each porter had 2 chests. Here 10800 is used 3 times, making 32400, or our number 324. Add 3600 mentioned once and we have 36000, to which, if we add the remaining 7200, we have 43200, wherein, by the combination, we obtain the other of our numbers 432. The intention to show the relation is obvious. These are the familiar numbers, with a like play upon them, in the Mound Builder works, but with the relation established as an interchangeable play upon geometric shapes and linear measures. The Chaldean account uses the numbers with relation to time and capacity measures, and men. The probably most important use of this number 432, with 234, was astronomical. Together 432 and 234 make 666. We see that $10800 \times 3 = 32400$ is a manifest play upon the number 432, and 32400 is the half of 64800. Let 64800 feet be the circumference of a circle, that is practically the circumference of the great Newark Circle, 2880×22.5. The diameter of this circle will be 20626.4700+feet. But as *seconds* in *time* measure 206264.700 *seconds*, is the *radius* seconds of a circle whose circumference is 360 degrees, and this particular radius is made use of in the common astronomical formula of to-day for finding the sun's distance. So, also, the ancient Egyptian Cubit, "Nilometer," has been measured as 20.625 British *inches* (Wilkinson). Use it as 20.62647 B. inches, a difference of .00147 of an inch in 20+inches, and the details of construction of the Great Egyptian Pyramid can be recovered, in the *actual measures* (British) made of those details by the most careful experts. Now 20625 is of itself a most important number, and shows itself in the constructive frame-work of the *denominations*

of the British measures which were used by the Mound Builders, as we see, and by the ancient Egyptians. So that in these mound constructions, we not only have the peculiar play of numbers common to the old Chaldeans and Egyptians, but also the same numbers applicable with the same identical unit of measure, viz.: the British inch. Let us explain this. It is objected to the British measures that they are imperfect, because, in the make up of the *rod*, a fractional number of *yards* and *feet* is made use of. The objection is a very short sighted one. 16.5 feet, or 5.5 yards make one *rod*. The *acre* is made by a rectangle 5280 feet, or one mile in length, by the half of one rod in width, or 8.25 feet, and 640 of these rectangles make one square mile. It will be observed that the length of one mile is 528 feet multiplied by 10; also, that the half of one rod is 8.25 feet, which, as *a number*, reads as the *reverse* or inverse of 528, indicating in feet the 10th of one mile. Is this peculiarity of inverse arrangement chance, or purposed? The latter, for they are changes derived from a common source, which numerically connects itself with the proportional elements of the circle, and those of the especial circle of 360 degrees alluded to. Divide 5280 by 256 and the quotient will be 20625, and divide 825 by 4 and the quotient will be 20625, the very number of the reported measure of the Nilometer Cubit. Thus, the number 20.625, in relation to our British mile, is an essential part thereof as a common factor in the make up of its denominations of measure, while 20.625 B. inches is, as seen measured as the recovery of the ancient Egyptian Nilometer Cubit. But the relation extends further. The late John A. Parker discovered the integral proportional relation, numerically, of circumference to diameter of a circle to be 20612 to 6561, the latter being the square of 81, which is the square of 9, which is the square of 3. This 20612, as 20.612 B. inches, has been shown to be the recovery of another ancient Egyptian Cubit, called the Turin cubit,* out of which springs the other or Nilometer cubit, thus: 20.612 B. inches : 6.561 :: 64.8 : 20.6264700 inches or the Nilometer cubit, in the last two terms of which proportion, we recognize the numbers mentioned above.

Now therefore, at the very center of a system of every variety

*This Egyptian cubit measure, in the Turin Museum, was measured with microscopic accuracy, by Bidone and Plana, and found to be .523524 of the French *meter*, or 20.61172 $\frac{1}{7}$ British inches; evidently from a great number of tests, and for convincing reasons, one of the two royal cubits, viz.: 20.612 inches, the other, as shown below, being 20.62647 inches.

and diversity of measures, we have *three* numbers *almost identical,* and each one a key to a variety or family of the system, viz : 20612, 20626.470017 and 20625. It was a part of ancient usage to obtain from simple numbers, easily carried in the memory, the use of fundamental ones. The number 20625 is easily had and easily discovered, and in our mound measures we have a key viz.: 12 and 21 feet. 7 times 21 feet is 147 feet, and 20625+.0000147 is 206264700, or one of the other numbers; while 20625 less 13 (and in the mounds we have a number of instances of the use of 13, in one especial instance, connected markedly with the numbers 110 and 210, pointing directly to this very use) is 20612, the third of the famous trio. Now all these shapes, measures and numbers, are presented in the Mound Builders constructions, and doubtless these very readings, were we sufficiently familiar with the use and relations of numbers, because the uses spring so easily, and naturally from the abundance of measures afforded, as the same measures are related to each other in construction. Everything points to the fact that the Mound Builders not only knew the *pi* relation, but also by use of the very numbers specified by their uses.

But, moreover, and what is a most singular fact, they did set it forth quite distinctly in a secondary and derivative form, and one which the writer has found to be used in the self same secondary way among the Asiatic ancients, which form is numerically, diameter 113, circumference 355.

This form is very ancient * and yet very modern. It is to be found in our elementary works. The established *pi* is 3.1415926, while this is 3.1415927.

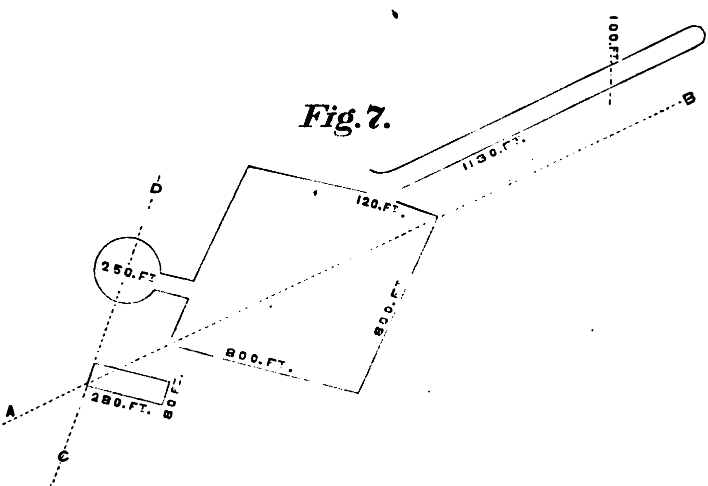
Such is what the writer judges to be a justifiable comment upon Groups I and II and III, together with this remarkable work of Seal Township, Pike County, Ohio. And now to resume the direct line of investigation thus interrupted:

As stated, the exceptions throughout the various works to the use of the typical numbers of measures is exceedingly rare; and

*It is found used in the books of Moses as a modified form of the *pi* ratio 6561 to 20612, and while the last is the base of a cubit measure, this one of 113 to 355, is used chiefly in matters of measures of time, especially in the symbolism of the scenes of Mt. Sinai. The multiple of this last ratio by 6 is 678 to 2130, which numbers are found in the Hebrew Bible as measures, (1) in the symbol of the circle of a "*head*," or the word RASH whose numbers are 213—(2) in the hieroglyphic use of the "*Dove*" and "*Raven*," whose numbers as used are 71x5=355, and the word "*and the-raven*," the sum of whose numbers is 678, and (3) in the zodiacal sign of the "*Two Fishes*;" the word "Fish" or *NUN* carrying the numbers 565, which multiplied by *two* equals 1130, and so on: which 2130 is the sum of 1080 and 1050 the measures found so typical and prominent in mound construction, in grouping different works, as seen.

certainly one of the most noteworthy is to be found on Plate 23, p. 63. This exception embraces "The Dunlap Works," Ross County, Ohio. They lay within one mile of the Cedar Bank Works, and within two miles of the Hopeton Works, already cited; consequently they can be taken as partaking of the nature of, and as a connected branch of development of the works of the Scioto Valley, the Newark Works, the Marietta Works, and so on. They are situated on the right bank of the Scioto river, six miles above Chillicothe. The copy of the survey is given as Figure VII.

Fig. 7.



Upon examination of the original plan the construction is singular, though not noticed by the surveyors. A trial test line *a b*, parallel to the long way, is the diagonal of the irregular square, and extended locates the corner of the rectangular out-work, whose long side is parallel to one side of the square. Constructing the rectangular out-work, the extension *c d* of its short side passes through the center point of, and as to a part, becomes the diameter line of the circle attached to the square. Thus the measuring numbers of these various parts become related to each other by geometrical construction.

On the long way of 1130 feet it will be observed the surveyors have shown a line 100 feet long, as its height (of breadth) vertical to the horizon. The rectangular out-work is 280 feet long by 80 feet broad, and its area is 22400 feet, the half of which is

11200 feet, to which, if 100 be added, the sum is 11300 feet, or 10 times the length of the long way. The same may be shown in this way: The height of 100 feet taken from 10 times the length of the long way, or 11300 feet, is 11200 feet, twice which, or 22400 feet, equals the area of the rectangular out-work. By this we are led to look to the divisions of the figures, or component parts thereof, by 2, and the use of such parts by means of additions and subtractions to show intended interrelations. So also we are taught by all the measures of the groups: (1) that the reverse or inverse reading of key numbers is used to produce as keys, other and controlling and correlating relations, such as, 24 may be used as 42, 528 as 825, 21 as 12; (2) that key numbers are divided into other parts to apply to differing geometrical shapes, as for instance, 2400 feet, the length of a long way, is divided into 1250 and 1150 feet, to show the conjugate diameters of an ellipse, and so on.

To show the application: Part of *c d* forms, for such purpose, the diameter line of the circle, which is 250 feet long, and this naturally divides into halves of 125 feet each, to form the radii of the circle. By sympathy, 280 feet of the length of the out-work, connected, as seen, with this circle, and with the long way, may be divided into halves of 140 feet each, so that from these parts we have the numbers 140 and 125 thus desired. We see the number 8 used about the works as the digit of 80 and 800. Divide 1130 by 8, and we have 14125, which is the sum of the two numbers, 140 and 125, used as $140+00125=14125$. Such relations show a purpose of checking, using and emphasizing the measures and parts of measures of the various parts by means of geometrical construction; but in this case all serve to concentrate upon and point to the number 1130.

But again take the measures and parts of measures of the out-work, located as a connecting constructive link between the 1130, and the 250 and 125 of the circle. 140 feet is 1680 inches, the eighth part of which is 210 inches, while 80 feet is 960 inches, the eighth part of which is 120 inches. Here we get the 21 and 12, which from the standard of 12 and 9 inches on the elliptical stone produce 1050 and 1080, the key numbers of the works in general; for $21\times5=105$, and $12\times9=108$.

What can there be of significance about the combined use of these two numbers, 1050 and 1080, fitting them to the scheme of common measure, adapted interchangeably to differing geometrical shapes, as, for instance, squares and circles?

Add together 1050 and 1080, and we have 2130. Divide this number by 6 and we have 355. We all know that 355 is the peculiar number, which, related to 113, gives in integrals the closest approximate numerical relation of diameter to circumference of a circle ever discovered in modern times, until John A. Parker found that of 6561 : 20612. And this seems to be the intended teaching of this group of the Mound Works.* It affords the numbers by which the geometrical relations of squares and circles can be interchangeably related or compared; while the other groups make such relations and comparisons, by the units of the standard practically adopted for actual measure. Which units refer to a basis of numbers by which measures of space and time may be correlated on squares and circles. The whole scheme, so far as geometry and numbers are concerned, is one which would naturally develop with all or any parts of the human race, independently of location, climate or family. That which could not be so developed would be the *practical unit of measure* adopted by which all relations might be shown in constructed works. We may adopt it as a truism that all peoples making use of this practical unit of measure must have derived it from a common source. The Mound Builders possessed it, so did the Old Egyptians, Hebrews, Romans, and, in modern times, the British people.

GROUP V.

This somewhat long and analytical investigation can now be appropriately closed with a description of the famous Newark Works, Licking County, Ohio, Plate 25, p. 67; upon the detailed measures of which the greatest pains were bestowed by Mr. Charles Whittlesey, Mr E. G. Squier, and Dr. E. H. Davis.

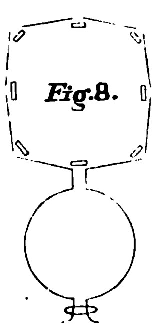


Fig. 8.

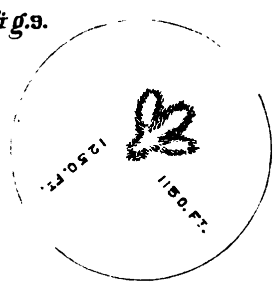


Fig. 9.

*While 1130 denotes a diameter to a circumference of 355×10, if 1130 be taken as a circumference value, it will in whole numbers indicate (with a decimal expression) a diameter of 360. With the Egyptians the Hebrew term Pharaoh was the number 355, the lunar year; which year was with the Hebrews the word *Shanah*, which carried this numerical value in the value of the word, while with both Egyptians and Hebrews they had the year of 360 days. The smaller lunar year of 354 days was "Pharaoh's daughter."

As to the plate it is said by the authors: "The map here given is from an original and very careful and minute survey made in 1836, by Charles Whittlesey, Esq., Topographical Engineer of the State of Ohio, corrected and verified by careful re-surveys and admeasurements by the authors. It may be relied upon as strictly correct." The chief object of giving this work is to show that the numbers of measures, viz., 24 feet, heretofore used on right lines, are transferred to designate the circumference of a circle. In the Hopeton Works we have a parallel way 2400 feet in length, connected with the great circle whose diameter is 1050 feet, and with the great rectangle whose side is 1080x10 inches. The especial feature of the Newark Works is the great circle of 24x120 =2880 feet in circumference, and the great ellipse whose conjugate diameters are, respectively, 1250 and 1150 feet in length. It will be seen that the sum of these diameters is 2400 feet, 12 times which is 10 times 2880, the circumference of the great circle, while their difference is 100 feet, or 1200 inches; so that the ellipse is made to be related to the circle by the length of the sum of its conjugate diameters. The circle, as is seen, Figure VIII, has a circumference of 2880 feet. Of it the authors say: "Unlike the other circular work, *this is a true circle*, two thousand eight hundred and eighty feet, or upwards of half a mile in circumference." It is connected with the octagon by a passage way 300 feet long by 60 feet wide. Recess to "Crown Works" 100 feet, about. Length of mound across crown work 170 feet. Within the octagon there are 8 mounds, rectangular truncated pyramids, each 100 feet long by 80 feet wide at base, and 5 feet high. Here at once, the relation of these works within the octagon to the cirumference of the circle becomes manifest, 100 feet is 1200 inches, 80 feet is 960 inches, and 5 feet is 60 inches, $960 \times 120 = 115200$, the $\frac{1}{40}$ of which is 2880 inches, the number, in feet of the circumference of this circle. So, also, the the octagon is a shape of 8 sides, and $2880 \times 8 = 23040$ which is 11520, or the area of the base of one of the mounds in the octagon, multiplied by 2. Moreover, this relation is also extended to the conjugate diameters of the ellipse. The sum and difference of 1250 and 1150 are, respectively, 2400 and 100 feet, or 28800 and 1200 inches, and the sum of the sum and difference of these is 57600, two-tenths of which is 11520, and the $\frac{1}{20}$th of which is 2880.

The ellipse is especially remarkable for the so called "bird

structure" which it contains, and its measures. As the circle is connected with an octagon, so the ellipse is connected with a square. The "bird mound," in the centre of the ellipse, affords, by reason of the measures of its various parts, a table of selected measures, the most of which are of familiar use throughout the groups in the valleys. It affords a table of typical measures. The description is as follows: "It can hardly be called a mound, but is rather a group of four, so arranged and connected as to constitute an unbroken outline. Denominating the figure, for the sake of distinction, a bird, the dimensions are as follows: Length of body 155 feet; of each wing 110 feet; (difference 45 feet); between the tips of the wings,* measuring in a right line 200 feet, width of body 63 feet; of wings, in centre, 45 feet; of same next the body 40 feet; height of mounds composing the body, 7 feet; of mounds, composing the wings, 5 feet. The head of the bird points directly towards the entrance of the enclosure. The bearing of the body is S. 65° E." Seriatim, the same measures in inches are 1860, 1320, 2400, 756, 540, 480, 84 and 60 inches. Here are the roots of our typical measures. $\frac{63}{6}=105$ and $63+45=108$. 110 is of itself one, and $110\times 12=1320$, which is used; and $1320\times 4=5280$. $105+108=213$, and $\frac{213}{6}=355$ which, with 113, measures the elements of the circle.

And now let us notice the fact of an identity of measures, by means of numbers of measures applied to geometrical relations, of these works with those of The Great Egyptian Pyramid. We have identity of idea, identity of inter-relation of geometrical shapes by common numbers, and *identity of the unit of measure* to accomplish this; a strange combination when we think that this identity applies to works on two separate continents; to one structure called the "wonder of the world," the evidence of the height of civilization, removed back in time beyond history, and to others which belonged to a race removed in time far back of the Egyptians, a race whose bones in the valleys are so "*very dry*," as to have

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*The use of *wings* calls to mind the Hebrew "*cherub*," which, in its great variety of forms, had one common feature, viz.: these "*wings*;" and these were certainly used as types of measure, (1), in the division of the length of the ark of the covenant, or 2.50 cubits, into two parts, viz.: 1.25, and 1.25 cubits, which division indicated the use of the two stones which were placed therein (*abn*, 125, *abn*, 125). These were to indicate, in connection with the name Jehovah and Sinai, the measure of the lunar year, for: the sum of the squares of the two sides of a square, the side being 354.3670548, the exact value of that year in days will be 521125, the square root of which will be 5011566, the diagonal of the square, a purposed change on the numbers of Jehovah's name and Sinai, to monument this astronomical value, and (2) in the division of the 20 cubits of the Holy of Holies by the wings of the cherubim. In the Hebrew Bible the ratio 113 to 355 is called "*The man (113) even Jehovah measure.*"

turned to powder, and a race which as yet had no tool to cut stone to build into their structures as the Egyptians did.

The diameter of a circle whose circumference is 2880 feet, is 916.7320+feet, and 2880 is a multiple of 24, for $24\times120=2880$. We have seen how intimately the numbers 1080 and 1050 are connected with 24 and 42, and how favorite a use the reversals of numbers are, as 12, 21, 24, 42; and so we might note it of 105 as 501, and 108 as 801.

Now the base side of The Great Egyptian Pyramid is 763.943+ feet, or diameter of a circle whose circumference would be 2400 feet. 763.943+feet is 9167.320+inches, which number, divided by 10, is 916.7320, or in feet the diameter of the Newark Mound circle. But we can carry the connection further. The half base side of The Great Pyramid is 381.971+feet, and $\frac{9}{10}$ths of this is 343.7745+feet. This is the length of The Descending Passage Way, in the pyramid. But 343.7745+is the diameter of a circle whose circumference is 1080, and 3437.745+*minutes*, is radius minutes of the circle whose circumference is 360 *degrees*. All the interior construction of the pyramid is built upon the use of the length of this passage way, which is 200 Nilometer cubits. So, also, the Hebrew divisions of time, the least and greatest, in the year, were embraced by the number 1080 (Basnage).*

One word more and we will finish. The reversed use of numbers is a favorite one with the old Hebrews in their Sacred Records. Here, with the Mound Builders, the writer finds it again, and these are the only instances of his finding it, with the one solitary exception of the measures of the rectangular area to make one British acre, wherein such area is $528\times10=5280$ feet long by 8.25 feet in width, the numerical value 528 being reversed to 825 (8.25 feet being the half of one rod).

After the close of the above, the writer visited Col. Charles Whittlesey, in Cleveland, Ohio, who personally assured him of the accuracy of the measures of the mound works referred to in the foregoing. He also stated that he, himself, had a manuscript lately completed, his own independent attempt at finding the standard of measure of the Mound Builders. He obtained it by finding an even factor which would apply in common, with various multiples, to some eighty measures of the mounds, selected as within his own

*That is, with the Hebrews, their least measure of time was the division of the hour into 1080 *chiliakim* or scuples, while the sum of the measures of the great circles of time were, 355 days for the lunar year, 360 days for the calendar year, and 365 days for the solar year, together $355+360+365=1080$ days.

knowledge to be relied on as accurate. This manuscript he shortly after published, and as I now recollect, found upon measuring his "*factor measure,*" that it was 30 British inches. By this it will be seen that two trials for such a standard, independent of each other, result in finding exact multiples of a common unit, viz.: the *British inch.*

APPENDIX A.

The History of the "Gridley Measuring Stone," or the Elliptical Stone found in the Fifth and Mound Street Mound, in the City of Cincinnati.

In the collections of Indian relics belonging to the Cincinnati Society of Natural History, is a small one, each member of which bears the printed form of label belonging to the old society called The Western Academy of Natural Sciences, formerly existing in the same city. The members of this small collection are labeled as follows: "No. 3, Indian relics deposited by C. P. Gridley," "No. 5, Indian Antiquities deposited by C. P. Gridley." "No. 6, Mound relics deposited by C. P. Gridley." "No. 7, Mound relics deposited by C. P. Gridley." "No. 12, Mound, Fifth street, deposited by C. P. Gridley." "No 13, Mound, Fifth street, deposited by C. P. Gridley." Of these the semi-elliptical stone measure of the text, the measures of which are there given by 9 and 12 inches, is the one labeled as "No. 5." This group, or small collection, passed with the rest of the collections belonging to The Western Academy of Natural Sciences into the possession of the Cincinnati Society of Natural History on its organization, and has been in that possession ever since to this date, February, 1883. This collection so labeled, consists of three fragments and two entire specimens; the two that are entire, being, first, the semi elliptical stone measure, or the "Gridley Measure." and second, a fine slate relic, of a shape lately described by Mr. Gridley.

The current tradition relative to this group has been that it consists of relics which were found in the Fifth and Mound Street Mound. Little if any especial attention has ever been paid to these relics. They have to appearance nothing to attract more than a passing glance, and seem valuable only in the general sense of being veritable Indian remains pertaining to our locality. Be-

yond this current report no certainty attached to them until December 5, 1878. On that day Mr. C. P. Gridley called upon Dr. H. H. Hill, of Cincinnati, a member of and an officer of the Cincinnati Society of Natural History. Mr. Gridley's object was to obtain possession again of the mound builder relics above mentioned, which he had loaned the Western Academy of Natural Sciences, and which, as said, had passed into the possession of the Cincinnati Society of Natural History. It seems that Mr. Gridley had removed to the city of Springfield some twenty-five years previously, where he had since lived, and where he now, at this present writing, resides. Mr. Gridley made a statement to Dr. Hill as follows:

"CINCINNATI, December 5, 1878.

"Mr. C. P. Gridley, of Springfield, O., this day called on me and stated that he was for many years a resident of Cincinnati, but moved to Springfield 25 years ago. While living here, and during the time the mound known as the Sixth and Mound Street Mound was being cut down, he frequently dug in it to see what he could find. After it was cut through, exposing the bed of ashes, charcoal, etc., (described by others) in the bottom of the mound, he dug into the bank immediately over the center of the ash bed, 3 or 4 feet above the level of the surrounding earth, and found some flint arrow and spear heads, two stone chisels, one slate ornament with a hole through it, several fragments of flat stone which he thought had been ornaments, and one flat stone with beveled straight edge, while the other was of an ovate form, wide at one end and running to a point at the other; length perhaps 10 inches; material fine grit stone—might be sand stone. 'At the request of Mr. S. T. Carley I deposited the above described relics in the collection of the Western Academy of Sciences, with the understanding that I could have them at any time he (I) wished to take them away.' He now wished to do so. After explaining to him how they were turned over to the Cincinnati Society of Natural History, and the difficulty of getting the matter satisfactorily before the parties concerned in the matter, he seemed to think it rather useless to attempt to get them. This interview was very satisfactory to me, as it settled in my mind the origin of the specimens, or, in other words, the fact that they were taken out of the mound known as the Cincinnati or Sixth and Mound Street Mound."

(Signed) "H. H. HILL."

While this statement was (as it is) of undoubted value as regards the relics, yet the exceedingly great value of the "Gridley Measure," as a discovered unit of measure belonging to the Mound Builders and the construction of the "Mound Works" of the Ohio Valley, made the writer collect all the facts possible with regard to it, and he wrote Mr. Gridley, receiving the following replies:

"SPRINGFIELD, CLARK CO., O., *Jan.* 29. 1883.

"DEAR SIR:—Yours of the 18th is received. In answer to your inquiries I would say that at the time of the removal of the mound I was residing on Longworth Street, near Mound Street, and often dug in it to find what I could. The relics were about 4 feet above the base of the same, and over a bed of ashes and charcoal, in which were found several skeletons partly in the ashes. I found the stone of this shape , and one with a hole in it, 2 stone chisels, and rough stone used to sharpen chisels on, and a copper ring which was on an arm bone of a skeleton. It broke in two after I found it and before I left it with the Antiquarian Society. If you will refer to Mr. Carley's antiquarian book you can find the day and date when deposited and the several items found. I believe they were found in the spring of '46. If you will call on the man who owns the lot he may be able to inform you of the year. As to the Gest stone, I believe it was found after mine. I think I saw it. The earth was deposited on Columbia Street or Second Street—the mound earth. If I could see you I could give you a description of what I found; but did not retain. I sold to Dr. Shotwell two skulls of singular form. A Mr. Clark was with Mr. Carley when I left the relics with the Antiquarian Society."

(Signed) "C. P. GRIDLEY."

The second reply is as follows:

"SPRINGFIELD, CLARK CO., O., *Feb.* 8, 1883.

"DEAR SIR:—In answer to your request I would say that it was over the center of the mound that I found these relics, and over the bed of charcoal of this form lying north and south 4x10 feet."

(Signed) "C. P. GRIDLEY."

Thus the location of the finding this measuring stone was at a depth of about 26 feet below the top of the ancient mound, and at or near its center, and the location of the find saves the relic from

any presumption of its belonging to a later, or what we call *intrusive*, deposit. As described by Dr. Drake, this mound measured 440 feet in circumference. A reference for the history of the removal of this mound, and for all that is to be gleaned as describing it, and the finding of the "Gest Tablet" is made to a pamphlet entitled, "The Prehistoric Remains Which Were Found on the Site of the City of Cincinnati, O., with a Vindication of the Cincinnati (Gest) Tablet," published by Robert Clarke, Esq., in 1876. The "Gest Tablet," which must always hereafter be associated with the "Gridley Measure," was, as per the descriptions in Mr. Clarke's valuable pamphlet, found at the center of the mound and about 4 feet above its base, so that the places of deposit of the two stones must have been very near the one to the other.

Mr. Gridley, having referred to Mr. S. T. Carley, who was a member of The Western Academy of Natural Sciences, and afterward a member of the Cincinnati Society of Natural History, I ascertained that Mr. Carley was a resident of Mount Holly, Clermont County, Ohio, and wrote him touching these matters. I received from him in reply the two notes following:

"MT. HOLLY, *Feb.* 4, 1883.

"DEAR SIR:

"Yours of January 31st received. I remember the circumstance of Mr. Gridley's depositing, in the collection of the Western Academy of N. S., a number of specimens of Indian relics subject to his demand. They were all labeled with his name. If the stone you allude to has his name attached to it, it is undoubtedly one of the lot he deposited at that time" (about thirty years ago). "At the time the Academy collection was transferred to the Society of N. H., nothing had been heard of Mr. Gridley for many years, so the specimens were thought of only as part of the collection. If Mr. Gridley should claim them, I have no doubt but the Society of Natural History will do what is right and just in the case. If the stone is of any special value, it will be worth more in a general collection than it could be in the hands of any single individual.

Respectfully,

(Signed) S. T. CARLEY."

"MT. HOLLY, *Feb.* 9, 1883.

"Dear Sir:

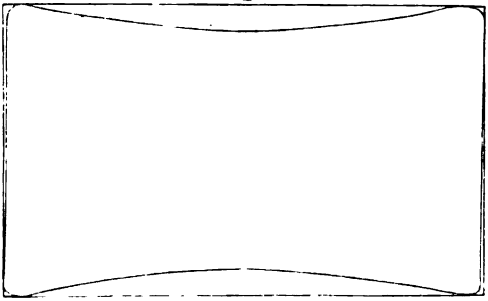
"It is with pleasure I acknowledge yours of the 5th, as it enables me to understand your purpose. Such a book as is referred to by Mr. Gridley" (the 'antiquarian book') "does not exist, but the records of the Academy of N. H. ought to contain an account of the transaction with Mr. Gridley, which must have occurred about the time you mention ('41). I remember the circumstances of the transaction distinctly, and I also remember the particular stone referred to. Mr. Gridley was in the habit of showing me his findings from the Fifth St. mound, so I feel sure the specimens deposited in the collection by him were found in that mound. Mr. Gridley could have had no motive to deceive any one in regard to the place where the stones were found. Besides, he was too honest to have done so. I know he went very often to the mound in search of relics, and I sometimes went there with him, but I never found any implements, but I once found three human skeletons, each lying on the back, extended, and the skulls of all three were crushed in from back to front, which I consider an unusual and interesting fact.

Respectfully Yours,

(Signed) S. T. Carley."

With this history of the Gridley Measure, we give Figure X the ac'ual measures of the Gest Tablet, *reduced to half size*, taken

Fig. X.



from the slab itself, as referred by try squares to a perfect rectangle. By calipers the measures of the stone are as follows: Extreme length 4.96–7 inches. Greatest width 2.99 inches. Least width 2.50 inches. Corrected by being referred to a perfect rectangle,

its measures are: Extreme length exactly 5 inches. Greatest width 2.99 inches, least width 2.50 inches. Chord of shallow arc on each side 4.50 inches.

Since writing the foregoing my attention has been called by Dr. Hunt, president of the Society of Natural History, to an article in the May number, 1843, of the "American Pioneer," published in Cincinnati. This article describes and figures the Gest tablet, and the Gridley relics, those referred to in his letter above, which include the "*measuring stone*," the subject of our main article. It speaks of "Figure 1" (the Gest tablet) as a carved stone, found at the bottom, and near the center of an ancient mound, "now being removed from Mound Street near Fifth, this city." The mound is described as about 25 feet high. From the place where this was found, "about ten feet distant in the mound, and nearly on the same level, were found parts of another skeleton, with a beautiful stone ornament four inches long, two inches wide and nearly an inch thick (figured), also, *a stone* instrument nine inches long and three wide (figured); this is about a fourth of an inch thick. The long straight side has a diamond shaped edge, as if it had been used for dressing leather. These (with others described) were discovered by and are in possession of Mr. Gridley of Longworth Street." The article says the Gest tablet was taken from the mound in 1841, and this, with Mr. Gridley's statement, fixes the date of the find of the "measuring stone."

APPENDIX B.

The following quotations are made from the The Smithsonian Report of The Ancient Monuments of the Mississippi Valley, to establish as far as possible the facts: (1) Of care and accuracy in the measures of the mounds; (2) Of identities and correlations of groups and measures, such as to prove in the minds of the surveyors, the possession by the Mound Builders, of a standard of measure, and some means of taking angles correctly; also a scientific and religious object in the construction of the works, and (3) Of a further proof of the correctness of the measures as surveyed.

As to taking and reporting the exact measures of the various works:

"Indeed, no exertion was spared to insure entire accuracy, and compass, line and rule were alone relied upon in all matters where an approximate estimate might lead to erroneous conclusions." Introduction page 34.

"These plans are all drawn from actual and minute, and in most instances personal survey, and are presented, unless otherwise specially noted, on a uniform scale of 500 feet to the inch. When there are interesting features, too minute to be satisfactorily indicated on so small a scale enlarged plans have been adopted. Sections and supplementary plans are given whenever it is supposed they may illustrate the description or assist the comprehension of the reader. The greatest care has in all cases been taken to secure perfect fidelity in all essential particulars." (Page 10.)

"To put all skepticism at rest, which might otherwise arise as to the regularity of the works, it should be stated that they were all carefully surveyed by the authors in person. Of course no difficulty existed in determining the perfect regularity of the squares. The method of procedure in respect to the circles was as follows: Flags were raised at regular and convenient intervals upon the embankments, representing stations. The compass was then placed alternately at these stations, and the bearing of the next flag ascertained. If the angles thus determined proved to be coincident, the regularity of the work was placed beyond doubt." (Page 57).

"The square or rectangular works attending these large circles are of various dimensions. It has been observed, however, that certain groups are marked by a great uniformity of size. Five or six of these are noticed in the succeeding pages; they are exact squares, each measuring 1080 feet to the side, a coincidence which could not possibly be accidental, and which must possess some significance. It certainly establishes the fact of some *standard of measure* among the ancient people, if not the possession of some means of determining angles." (Page 48.)

As to the plan of the Newark Works, in foot note to page 71: "A number of plans of these works, as well as of those at Marietta, have been published; but they are all very defective, and fail to convey an accurate conception of the group. The map here given is from an original and very careful and minute survey made in 1836 by Charles Whittelsey, Esq., Topographical Engineer of the State of Ohio, corrected and verified by careful re-surveys and

admeasurements by the authors. It may be relied on as strictly correct." A similar explanation is made on "page 73" as to the plan of the Marietta works.

But apart from these statements of exactitude there is a proof of it to be had from the measures themselves. The works consist of groups, in some instances separated from each other by many miles, yet on the compilation from the field notes it soon became manifest from the surveys that there was identity of groups and measures as stated. Thus besides the care taken in the admeasurements of individual groups, justification was found in the agreement of measures of these with other and similar groups, upon which equal care had been bestowed This statement is made by the authors.

As to the coincidences of measures:

"It is not to be supposed that these numerous coincidences are the result of accident." (Page 71.) "Although in the progress of investigation singular coincidences were observed between these works, yet there was at the time no suspicion of the identity which subsequent comparison has shown to exist." (page 56.) Again: "There is one deduction to be drawn from the fact that the figures entering into these works are of uniform dimensions, which is of considerable importance in its bearing upon the state of knowledge among the people who erected them. It is that the builder possessed a standard of measure and had some means of determining angles. * * The coincidences observable between them could not have been the result of accident, and it is very manifest that they (the works) were erected for common purpose. What the purposes were the reader must judge. Without entering into any argument upon the subject, we may content ourselves with the simple expression of opinion that they were in some manner connected with the superstitions of the builders." (Page 61.) As to a *unique* work in Seal Township, Pike County, Ohio, they say: "It is impossible to resist the conviction that some significance attaches to these singular forms." (Page 67). As to the Portsmouth works they say: "Whatever may have been the divinity of their belief, order, symmetry and design were among his attributes; if, as appears most likely, the works that most strongly exhibit these features were dedicated to religious purposes, and were symbolical in their design." (Page 82.) As to the works in Montgomery County, Ohio: "It tends to confirm the impression produced by the other works that some significance attaches to the combination

of the two circles and the square." (Page 83.) As to the Newark works: "Several extraordinary coincidences are exhibited between the details of these works and some of those already described. The smaller circle F is nearly identical in size with that belonging to the "Hopeton Works," and with the one attached to the octagon in the High Bank group (see plates xvi. and xvii.) The works last named are situated upon the Scioto, seventy miles distant. The square has also the same area with the rectangle belonging to the Hopeton, and with the octagon attached to the High Bank works. The octagon, too, has the same area with the large irregular square at Marietta. The small circles, G, G, G, betray a coincidence with the works above mentioned, which ought not to be overlooked. It is not to be supposed that these numerous coincidences are the result of accident." (Page 71.) So on page 66 they say: "It will be remarked that we have here the square, the circle and the ellipse, separate and in combination, all of them constructed with geometric accuracy."

We have still another series of measures which go far to confirm the accuracy as to those given of the groups of works quoted. Many of the tumuli covered *altars*, so called, located generally on the ground level, and at the center of the mounds in which they were respectively built. These altars were curiously constructed. The shape was first marked out, and a portion of ground dug out to the depth required. This space was filled with sand, beaten down very compactly. Fire was used upon this until the substance of the altar became solidified to a mass, preserving its shape and substance, as if a solid stone. Above this, quite often, another, and sometimes a third altar was constructed, of definite regular shape, followed by the same use. Over these finally the earth was heaped and the mound formed. By this the altar in its integrity would be preserved for any number of years. The measures of some of these altars, as they are stated in the article on "Sacrificial Mounds," commencing with page 144, are as follows: "No. 1. A circular base 9 feet, or 108 inches in diameter, diameter of top 3 feet, or 36 inches, depth 9 inches. No. 2. Rectangular base 10 feet, or 120 inches long, 8 feet, or 96 inches broad. Top 6 feet, or 72 inches long, by 4 feet, or 48 inches broad, height 18 inches. No. 3. Square base 10 by 10 feet, top 6 by 6 feet, and a circular bowl in this of 4 feet in diameter. Depth of altar 22 inches, sinking a foot or more below the original surface of the ground. No. 4. Second and upper altar 8 feet by 8 feet." Here,

the application of the small measures, in inches and feet, is as natural to us as if these units of measure had been used by the ancient builders, and seems to comfirm the measures reported of the large works in the open.

The extreme antiquity of the works is marked by the frail decayed condition of the bony structure of the remains, and this is to be emphasized because of their perfect protection from chemical disintegration and other wear since the time of their deposit. To somewhat illustrate the duration of bony structure: Schlieman, at the Agora in ancient Mycenae, found the tomb of Agamemnon containing several remains. The bodies had been carefully interred and protected, partly by gold masks. "The bones and even the skulls had been preserved; but these latter had suffered so much from the moisture that none of them could be taken out entire." The Trojan war has been estimated at about 1700 B. C., or about 3600 years ago. The remains in the ancient mounds, such as those of the mound in question, are too much reduced to dust for preservation, save the jaw bones and teeth.

PAPERS ON THE DESTRUCTION OF NATIVE BIRDS.*

FIRST PAPER,

By Mr. Chas. Dury.

(Read at Special Meeting, May 25, 1886.)

In the year 1861 I first became interested in birds, and particularly those of the vicinity of Cincinnati. During the twenty-five years passed since then a great change has taken place in the Avian fauna of this locality. Then the beautiful wild pigeons, in their autumn migration, came over this country in countless myriads, but for the last three or four years none have been seen. and even the far-reaching market shooter has failed to furnish any for sale. They have been exterminated in this locality. From 1860 to 1870 geese, ducks, snipe and other water birds passed over in swarms to and from their breeding grounds in the North. They, also, are fast sharing the fate of the pigeons, as hardly two in a hundred of former numbers remain. As late as 1875 several covies of quails lived within the limits of Avondale, of whose numbers not a survivor now remains.

Change of habitat and cheap and improved shotguns have wrought fearful destruction among our beautiful game birds.

The inventors who are continually improving the killing qualities of breech-loading and repeating shotguns would do well to turn their attention to inventing some method by which the game the guns are to be used on can be saved from complete destruction. Florida, perhaps, better than any other State in the Union, shows the work of the destroyer, and in a shorter period of time. When I first visited that State in 1875 with some gentlemen of the Cuvier Club for the purpose of collecting some specimens of birds and fishes for the club's museum, we were astonished at the great number of beautiful aquatic birds we saw at all suitable places.

The egrets, herons and pelicans congregated by thousands in the rookeries. The snowy plumage of the egrets as they perched in the dark foliage of the mangroves gave a color to the landscape. The hand of the destroyer had but begun the work of destruction.

*The eight papers following were read as noted in the proceedings. Most of them were published in the Cincinnati Commercial-Gazette soon after their presentation to the Society. They are reprinted entire at the request of a number of members of the Society.

From the decks of the river steamers was fired a constant fusilade of rifle balls and shot, directed at every bird and alligator that showed itself. Of those killed or wounded none could be secured by the vandals who so cruelly murdered them—they were left to rot where they had fallen. Three years later when I again visited these localities the birds had greatly diminished, in fact it was difficult to secure specimens of some of the species which were before so abundant. During the winter just past several gentlemen of the Cuvier Club went over the same ground and report the work of destruction completed, the rookeries silent and deserted, the occupation of the professional bird slayers gone.

Dr. Henshall says during his last trip to the west and south coast of Florida he met the agent of a Boston milliner, who had brought with him fifty breech-loading guns and a large supply of ammunition. These he distributed among the residents, with orders to shoot as many "plume birds" as possible, for which he would pay them liberally, as he had orders to secure fifty thousand.

I visited a pelican rookery near Ft. Capron, on the Indian River, and was horrified at the sight I saw there. Scores of dead parent birds were floating in the water and scores of helpless young ones starving in their nests; and this infernal outrage inflicted in the name of sport by a party of so-called gentlemen sportsmen from the East.

Mr. Henry Hanna says, when he first visited St. Augustine, fifteen years ago, the cerlew, godwits and other shore birds were so abundant that the sportsman could, in a few hours at low tide, shoot as many as he could carry away. On the same ground during the past winter he did not see a shore bird! Similar reports come from all localities that were once famous for their bird life. Deserted rookeries and depopulated beaches are hideous monuments of the wanton destructiveness of the American tourist and the plume-gathering wretches who cater to the depravity of fashion.

I visited a dealer in bird skins, in New Jersey, with whom I was well acquainted, and saw in his stock thousands of birds and parts of birds. He had our beautiful native blue birds put up for hat and bonnet ornaments by the bushel. I was astonished that there were so many blue birds in the State as he exhibited, and he assured me there were some left yet, which he and his agents had not yet secured, owing to the interference, as he expressed it, of

some game clubs who threatened him with prosecution if he did not stop his inhuman work.

He was particularly severe on the scientific men, as he called them, who criticised his methods and only bought from him one or two of a kind. The demands made on him by the milliners were so great that none were obtainable for scientific specimens. I have always found that when the pocket-book of science and the pocket-book of fashion come in competition, science gets left every time.

A lady of this city, who deals in feathers for decorating head-gear, sent for me recently to look over a large case of birdskins she had just received from Texas. This case contained hundreds of meadow larks and many other birds, so badly prepared, dirty and greasy as to be completely worthless for any purpose whatever—a complete waste of so many valuable birds' lives.

The lady who had received the box, to her credit, said: "What a shame to kill such a lot of birds. I wish they would end this stupid bird-wearing fashion."

Neither rarity nor exquisite song has been any safeguard to shield a species from giving up its valuable life to the insatiable demands of fashion. I have seen hundreds of yellow-breasted chats, and the sweetest of American songsters, the wood thrush, wired and mutilated almost beyond recognition for this devilish purpose.

Bunches of wings of the European skylark prove that even it has not escaped the general destruction. Think of killing such a bird for such a purpose! A creature that has inspired many of the poets of the British Isles, and of whom Jas. Hogg, the "Ettrick Shepherd," has written:

I.

"Bird of the wilderness,
Blythsome and cumberless,
Sweet be thy matin o'er mountain and lea;
Emblem of happiness,
Blest in thy dwelling-place,
Oh, to abide in the desert with thee!
Wild is thy lay and loud
Far in the downy cloud,
Love gives it energy, love gave it birth;
Where on thy dewy wing,
Where art thou journeying?
Thy lay is in heaven, thy love is on earth.

II.

"O'er fell and fountain sheen,
O'er moor and mountain green,
O'er the red streamer that heralds the day,
Over the cloudlet dim,
Over the roinbow's rim,
Musical cherub, soar, singing away!
Then when the gloaming comes,
Low in the heather blooms,
Sweet will thy welcome and bed of love be!
Emblem of happiness,
Blest is thy dwelling-place,
O to abide in the desert with thee!"

I have not mentioned why birds should be perpetuated. Either from an æsthetic or economic point of view, birds are of the *utmost* value, and to all persons of average intelligence this fact is too apparent to need mention.

In the supplement to Science of February 26, 1886, Mr. J. A. Allen, of New York, has one of a number of very able papers on the destruction of bird life in the United States. In this paper he speaks of one of the important agencies in bird destruction as the "small bad boy"—and in an ornithological sense his name is legion—of both town and country. Bird-nest robbing is one of the besetting sins, one of the marks of natural depravity of the average small boy, who fails to appreciate the cruelty of systematically robbing every nest within reach, and of stoning those that are otherwise inacessible. To him the birds themselves too are a fair target for a stone, a sling or a pea shooter. To the latter many a sparrow, thrush or warbler falls a victim. Two ten-year-old lads in Bridghampton, L. I., confessed this autumn that with these rubber pea shooters they had killed during the season fifty robins and other birds which frequent the garden, orchard and cemetery. I can bear abundant testimony to Mr. Allen's statememt. For twenty-seven years I have lived in a large country place filled with trees and birds, which we have protected to the best of our ability from the depredations of cats and small boys. Whenever I got a chance I removed the cats with a shotgun and accelerated the departure of the bad boy with anything throwable that came handy. This spring I have seen several dead and crippled birds around the place that I know were victims of the deadly pea shooter. A few days ago as I stood unobserved in a cluster of bushes a rock whizzed past my head, thrown at a cat bird by a trespassing young

vagabond, and I have given thanks ever since, as the clod which I hurled back at him hit him square in the ribs and nearly knocked the breath out of him. As he made off, he looked around, wondering where the clod could have come from. In Mr. Allen's article above mentioned he quotes a recent writer in saying, "A garden without flowers, childhood without laughter, an orchard without blossoms, a sky without color, roses without perfume are the analogues of a country without song-birds. And the United States are going straight and swift into that desert condition." It is useless to talk about laws for the protection of our song-birds: we have had for years good laws on the subject, but it is impossible to enforce laws where it is so difficult to catch and convict the offenders. So long as there is a demand for these birds just so long will the market be supplied, law or no law. It all depends on the ladies who wear birds for decoration whether our beautiful songsters shall be exterminated or not.

SECOND PAPER.

By Wm. Hubbell Fisher, Esq.

(Read May 25, 1886.)

Life is a wonderful and mysterious thing. Man may take life, he may blot it out, but he can not give it back to the lifeless clay. Has he a right to take life? That he has the right to take the life of his fellow-being for any reason whatsoever is denied by some. The majority of the people of civilized communities have held that capital punishment—the taking of the life of the one who commits the capital crimes of murder or treason—is not only justifiable but necessary for the prevention of like crimes by others; that any others among the remainder of the people having a wish to commit these crimes, seeing justice thus swiftly and thoroughly administered, will take warning and desist from their committal.

In some countries arson is punished by death, while, on the vast plains of the great West, horse-stealing is punished by death by the unanimous verdict of the people, for the reason that detection is difficult, catching the prisoner alive is difficult, and more particularly that capital punishment there appears to be the surest and most effective means of extirpating a system of robbery which

attacks the article, the thing most necessary to the ranchman for the preservation of his own life and property.

Thus we see the legal taking of human life deliberately in civilized communities is founded upon a reason, and upon a deliberate and thoughtful one.

The taking of life of animals (other than man) ought to be founded upon good and sufficient reasons. These reasons may be grouped under one great division, viz.:

The preservation of man himself.

This includes—first, the destruction of those animals which either directly destroy the man himself or destroy his food or other things essential to his life and welfare; and secondly, the taking of the life of animals useful to him for food or clothing. As to wild animals of the cat tribe, from the lion and tiger down to the wild-cat, the various species of wolves, the bears and many other species of quadrupeds, many of the species of snakes, the crocodile, the alligator, the man-eating shark—about all these and others of like ferocity the question of the right to take their lives can not arise. The right is too clear for question. Under this category none of our birds can fairly be classed, it being a remarkably rare instance in which any bird, even though of the hawk kind, or the owl kind, or the eagle, attacks man.

Hence the right to take the life of our birds can not be based upon the reason that they attack man or that the man needs to destroy them because they will directly attack him.

Let us look at some of the animals in the light of the proposition that the life of those animals which destroy the food of man, or other things essential to his life and welfare, should be destroyed. The weasel and fox and like animals which destroy our domestic poultry, and thus waste, diminish and destroy our food supply, certainly belong to this class.

How is it as to birds? First, as to the hawks and owls. Not long ago the great State of Ohio, following in the train of some of her sister States, enacted stringent laws for the destruction of hawks, offering a premium for the head of each hawk, delivered, of fifty cents. This bountiful reward attracted great attention, as it amounted to paying more for a rapacious bird than the pot-hunter or country lad could get by sending a duck or quail to market. Immense numbers of hawks were destroyed. Some were shot and some were trapped. A couple of hunters in New Hampshire secured for bounties a fabulous number of hawks. The

supposition has been that the hawks were the enemy of man; that they destroyed his poultry, particularly the smaller kinds, and were of no possible good or utility. Hence, one of the earliest recollections of the country boy is that the announcement of the presence of a hawk served to bring out the shot-gun, or caused the neighbor's to be borrowed, and immediate war upon that bird was the order of the hour.

Where ignorance is bliss is it not folly to be wise? Well, sometimes; but often it is folly not to be wise, as the bliss of ignorance soon changes into the sorrow and mortification of loss. It appears that on June 23, 1885, the Assembly of Pennsylvania passed an act for the destruction, among other things, of hawks and owls, and offered fifty cents per head for every hawk and owl, except the Acadian screech or barn owl.

The Westchester (Pa.) Microscopical Society took the matter in hand. They state that Dr. B. Harry Warren, Ornithologist of the Pennsylvania State Board of Agriculture, had devoted several years to the collection, dissection and examination of birds; and that "all of the committee from observation and experience have believed that all of the birds denounced in the law above quoted, with rare exceptions, have been found to be the best friends of the farmer." The committee further state that lest any of the committee might have been mistaken, "they have corresponded with the best ornithologists in the country, connected with the Smithsonian Institute, to-wit: Dr. C. Hart Merriam, Ornithologist of the United States Department of Agriculture," viz.: Of the Division of Economic Ornithology, whose special business it is to understand the relation and uses of birds to agriculture, and to each other, and to the welfare of man; "Robert Ridgway, Curator of the Department of Birds, United States National Museum; Dr. Leonard Stejneger, Assistant Curator of the same department; H. W. Henshaw, of the Bureau of Ethnology, also a collector of birds for the Smithsonian Institute and connected with the late Wheeler survey of the territories; and Lucien M. Turner, a collector of birds, etc., for the Smithsonian Institute for the last twelve years." The answers of these parties are annexed to the report and speak for themselves, and go to corroborate the report, viz., that "the hawks and owls are of great benefit to the farmer, and render him far greater service than injury, and that it is unwise to select any of them for destruction."

The majority of the species of hawks and owls live upon small rodents, as field mice and insects. The great horned owl sometimes preys upon birds, as do also the Cooper's hawk and the sharp-shinned hawks, but the other hawks live mainly upon insects and field mice and the like, as do also most of the owls. The beautiful sparrow hawk lives almost exclusively upon insects.

What did the committee do? They did just what they should have done, viz.: They passed resolutions to the effect that the act of June 23, 1885, offering a premium for the destruction of hawks and owls is unwise and prejudicial to the interests of agriculture; and they decided to request their members of the Legislature to aid in its appeal.

Two papers read before this society, one by Mr. J. W. Shorten and another by Mr. Charles W. Dury, give the results of these gentlemen's examination of the contents of the stomach of rapacious birds, and confirm the position taken by the society of Chester County.

The point I make here is this, that the farmer or poultryman has the right to shoot any hawk or owl he knows is depredating on his poultry. But it is not just for the State or for fashion to encourage the wholesale destruction of these birds.

We come now to that class of birds that eat cherries and other small fruits. The question is as to whether the birds do more harm than good the season through. If they do more good than harm, they should be spared and nourished. You see the question is not one of sentiment; it is one of dollars and cents and of pure business. Of course many of our feathered friends love berries. Where the main crop of the farmer consists of small fruit he is entitled to shoot the small marauders, and, what is more to the point and more effective, suspend pieces of tin by cords to be waved by the breeze, and other scarecrows. But the majority of farmers are not large growers of small fruits. One of the greatest enemies the farmer has to contend with are insects There are insects who eat his trees, working under the bark. Insects attack his wheat, his corn, the fresh leaves of his growing vegetables. What about the potato-bug, the locust, wholesale destroyers of the crops—the countless insects that live upon and destroy the flowers of the horticulturist and florist? Right here I will quote extracts from the remarks of Charles A. Green, Chairman Committee on Ornithology, W. N. Y. H. Society, Rochester, N. Y.:

"Fruit-growers and farmers do not appreciate the importance of the birds that nest in their fields and orchards, or follow the paths of their plows and harrows.

"There is great need for protection of birds, yet the average ruralist is not familiar with the name of one bird in ten that inhabits his fields, thus is not able to distinguish the most delightful songster or the most effective insect destroyer.

"Each living creature has its use in the economy of nature, and no species can be annihilated without disturbance of equilibrium. The flies are useful scavengers. Mosquitos, worms, snakes, toads, and all forms of life, were designed for a good purpose. One race may do service in keeping the other in check.

"There are birds worn by our city belles that alive would accomplish more good work for mankind than the average fashionable belle, although she lived for a century. The eyes and beaks of these dead birds cry out in shame against the cruel fashion that causes their slaughter.

"I once heard an intelligent fruit grower exclaim: 'Shoot the birds; they are eating my cherries.' Why not as well say, 'Shoot the horses, they are eating my oats; shoot the cows, they are eating my hay; shoot the chickens, they are eating my corn; shoot the children, they are eating my bread.' If the horses, cows, chickens and children are useful and desirable features of our homes, we must not destroy them; neither must we destroy the birds if useful and desirable.

"Five thousand miles is not a long distance for birds to migrate. They often breed in one locality and feast in another. But wherever they go, wherever they alight for a mouthful of food, the gun, trap, cat or robbers await them. How long will the race survive such treatment? Is this not a question worthy of consideration?"

There is one bird of the family of the fissirostal or split mouths, called in popular phrase the night-hawk (*Chordeiles Virginianus*). He is no more of a hawk than is a pigeon. He is entirely an insectivorous bird. When I was younger, I shot one of the birds. I skinned it, and, according to my custom, I examined his crop and found that it contained grass hoppers and other insects and nothing else, and enough of them to fill a half-pint cup about full. Now, to go on shooting this bird on the supposition that it was a bird which preyed upon other birds, would be more than a blunder, it would be a calamity to the

farmer. Most of our song-birds are insectivorous birds, and so are the woodpeckers. We therefore protest against the destruction of our birds, and think that they should be protected by public sentiment for the reason that they do more good than harm.

The increase of insects is marvelous. One insect may in one year become the progenitor of six billion descendants. Three hundred and twenty-five actual species of insects are known, and it is thought that there as many more species unknown. If undisturbed, insects would destroy every green thing upon the earth's surface, and men would perish; but nature has provided enemies, and prominent among them are the birds, which keep the insects in check without cost to the horticulturist.

"A swallow, as it skims through the air on a summer day, will destroy more insects than a farmer in the same length of time sweating over a heavy bucket of Paris green mixture.

"As the country became cleared of timber and more thickly inhabited, the birds have been destroyed in large numbers, and insects have gained the ascendancy."

The question of the destruction of birds for food rests upon a solid basis.

Certain kinds of birds, viz., many of the ducks and waders, are universally recognized as fit for food. To the shooting of these, under proper restrictions as to time and place, there appears to be no reasonable objection. As to one class of birds there exists a difference of opinion whether they should be eaten or not. At Hampton, Va., two and one-half miles from Fortress Monroe, I saw robins hung up for sale in the market. Alongside the cemetery at Richmond, in the same State, I saw a gunner stealthily hunting for robins. At the markets in the Nation's Capital, I have seen exposed for sale bobolinks—there called reed birds—stripped of their feathers and fastened together in bunches like radishes. I could not eat the birds. In New England the killing of these birds is prohibited, while in the South many sportsmen shoot them for sport, and thousands of them are eaten. The amount of food in one of these birds is so small that it seems an unequal equivalent for the destruction of such a sweet songster as is the bobolink, which James Russell Lowell so delightfully describes. And yet even the destruction of game birds for food has been so great that the hunter views with anxious eye their rapid disappearance. The prairie chicken (pinnated grouse), once so plentiful in

the Eastern part of the United States, has there become a thing of the past. So has the wild turkey, and to a great extent the wild pigeon. The vast number of ducks and waders, the snipe and the plover, have been perceptibly lessened. The great northern migration of most of these birds takes place through the central part of the United States, in the path of the Mississippi and her tributaries, and the great lakes, and occurs in the spring time.

At that time the birds are usually thin and poor, and are not very desirable for food. They are going north to breed, and the destruction of each pair then means the destruction of not only that pair, but another pair, and often several more pairs of birds which would follow the spring and summer hatch.

I am glad to notice that the new Ontario (Canada) game law forbids the killing of ducks and other water fowl between January 1st and September 1st; also snipe, rail and golden plover between January 1st and September 1st. It is is also pleasant to chronicle that the game clubs of the Central United States are moving in the direction of prohibiting spring shooting. Right here let me call your attention to a most ancient and interesting game law.

The law of Moses provides that every seventh year the land should have rest and what grew in that year was for the game. The inference is clear that the game was that year to be unmolested. [See Exodus 23, 11; Leviticus 25, 7.]

Michaelis, volume 2, page 419, says: "It is the command of Moses [Deut. 22, 6, 7,] that if a person find a bird's nest in the way, whether in a tree or on the ground, though he may take the eggs or the young, he shall not take the mother, but always allow her to escape. It is clear that he here speaks not of those which nestle upon people's property. * * * He merely enjoins what one has to do on finding such nests on the way, that is without one's property, thus guarding against the utter extinction or too great diminution of any species of birds indigenous to the country."

Many readers may think it strange that Moses should be represented as providing for the preservation of noxious birds; yet, in fact, nothing can be more conformable to legislative wisdom. To extirpate, or even to persecute, to too great an extent, any species of birds, from an idea of its being hostile to the interests of the inhabitants, is a measure of doubtful policy. It ought, in general, to be considered as a part of nature's bounty, bestowed for some important purpose; but what that is we certainly discover too late when it has been extirpated and the evil consequences of that

measure are begun to be felt. In this matter the legislator should take a lesson from the naturalist."

Linnæus gives two remarkable examples to confirm it. One, in the case of the little crow of Virginia (*Gracula Quiscula*), extirpated at great expense on account of its supposed destructive effects, and which the inhabitants would soon gladly have reintroduced at double the expense. The other the Egyptian Vulture (*Vultur Percnopterus*). This species of crow constantly frequented the pea fields, and to put a stop to its ravages its extirpation was resolved upon. As soon as this was effected, an insect of the beetle kind multiplied to such a degree that very few peas were left. A naturalist found that the crows were not in quest of peas, but only devouring the beetles.

As for the vulture, Linnæus says that these creatures of prey rid the earth of dead carcasses and make it wholesome and comfortable, besides serving to maintain a due proportion between the different animals, and to prevent any one kind from starving the rest.

In addition to this detail, I subjoin what follows in the same magazine, relative to the crow in Sweden: "At somewhat less ex pense the same truth was some time ago confirmed in Sweden. The common crow (*Corvus cornix*, Linn.) was thought to be too fond of the young root of grass, being observed sometimes to pick them out and lay them bare. Orders were therefore given to the people to be at all pains to extirpate them, till some person, more judicious, opposed this, and showed that it was not the roots of the grass, but the destructive caterpillars of certain insects which fed on them, that the crows searched for and devoured." [Michaelis' Laws of Moses, Vol. 2, p. 421 et seq.]

There is a great slaughter of birds carried on by the young boys. Near where I live, in the heart of the city, lives a boy who carries a stone-slinger, and that boy in one day killed ten sparrows, eight of which fell to the ground alive, to use the phrase of one of his young companions—which meant wounded. Last evening, a lady, just from the suburbs of St. Louis, stated that, next door to where she was there staying, a small boy, ten years of age, had a gun, and got up early every morning and shot at everything of the bird kind he could see.

Probably some of you read the article in one of our daily papers lately in which the writer stated that when walking in the forests in the vicinity of this city, he saw a boy, accompanied by a

gentlemen, who was practicing shooting at the birds in order to become an accurate marksman. So the gentleman said, and, although the boy had only a simple air-gun, several birds fell dead, one of which was startled from her nest, in which were several eggs. There is no excuse for this wanton slaughter. The bird is not used for food nor the skin saved.

The last question to be considered is: Is the killing of birds authorized for the purposes of dress and fashion?

The killing of fur animals for their fur, to be used as clothing, is doubtless justifiable. But the skins of birds, particularly of our song birds, are too small to be thus utilized. The amount of life sacrificed to make a single dress of bird skins would be slaughter. Such dresses are not needed, would be very expensive, and not nearly so useful or economical as the textile fabrics of every shade and hue from the plain or figured calico to the gorgeous silks and elegant fancy stuffs now in use. But we are not called upon here to meet such a use of bird skins. We are to meet the use of bird skins and birds' heads worn, not for warmth or protection, but for ornament. The question is: Is this ornament in the highest and truest sense? I think not. I am not now referring to ostrich plumes, but to the heads and bodies fastened upon hats or located in the festoons of dresses and the like.

In the "Forest and Stream" of March 18, 1886, appears the following:

"The feather-decked hats reach their highest developement at the great gambling resort of Monte Carlo, where, according to the London World, the ladies' hats are as high as the play. Three girls, presumably sisters, and undoubtedly Americans not in society, attract an immense attention by reason of their showy garments. They wear very high conical hats, ornamented in front with large green and yellow parrots with glaring glass eyes. Each bird is perched on a little bough, and it is impossible to imagine anything more ludicrous or in worse taste. The girls are incessant talkers, and, my correspondent tells me, they are known by the nickname of the 'Prattling Pollies.'"

My brother lecturers this evening have given you many figures on this subject.

The startling truth is that a great portion of the supply of plumage does not come through the custom-house. Hundreds of thousands of birds slaughtered for trimming are American song-birds. From a single locality on Long Island were sent in during

the week ending July 26, 1884, over $300 worth of birds. The same man sent, during the season of four months, not far from seventy thousand birds.

Charles Dudley Warner, in a note to the Forest and Stream, writes:

"Your note about the Audubon Society followed me to Mexico and here. After this long delay, if it is of any service to you, I should be glad to be quoted as in entire sympathy with its object. A dead bird does not help the appearance of an ugly woman, and a pretty woman needs no such adornment. If you can get the woman to recognize these two things, a great deal will be done for the protection of our song-birds."

A writer in the Evening Post, of April 7, says: "My visit to the National Academy was spoiled yesterday. Not by viewing bad pictures, either. It was by a young lady's hat. There was nothing in her face to denote excessive cruelty. Indeed, she was very pretty, and the attention she paid to the best pictures seemed to indicate that her artistic taste was not uncultivated. But her hat! The front rim of this was decorated with the heads of over twenty little birds. I counted them at a risk of seeming to stare rudely. These heads were simply sewed on side by side as closely as possible."

Celia Thaxter writes to the Boston Transcript: "But women do not know what they are doing when they buy and wear birds and feathers, or they would never do it. How should people brought up in cities know anything of the sacred lives of birds? What woman whose head is bristling with their feathers knows, for instance, the hymn of the song sparrows, the sweet jargon of the black-birds, the fairy fluting of the oriole, the lonely, lovely wooing call of the sandpiper, the cheerful challenge of the chickadee, the wild, clear whistle of the curlew, the twittering of the swallows as they go careering in wide curves through the summer air, filling earth and heaven with tones of pure gladness, each bird a marvel of grace, beauty and joy? God gave us these exquisite creatures for delight and solace, and we suffer them to be slain by thousands for our 'adornment.' When I take note of the headgear of my sex a kind of despair overwhelms me. I go mourning at heart in an endless funeral procession of slaughtered birds, many of whom are like dear friends to me. From infancy I have lived among them, have watched them with the most profound reverence and love, respected their rights, adored their beauty and song, and I could

no more injure a bird than I could hurt a child. No woman would if she knew it.

"The family life of most birds is a lesson to men and women. But how few people have had the priviledge of watching that sweet life; of knowing how precious and sacred it is, how the little beings guard their nests with almost human wisdom, and cherish their young with faithful, careful, self-sacrificing love. If women only knew these things, there is not one in the length and breadth of the land, I am happy to believe, who would be cruel enough to encourage this massacre of the innocents by wearing any precious rifled plume of theirs upon her person. In New York one firm had on hand February 1, 1886, two hundred thousand skins. The supply is not limited by domestic consumption; American bird skins are sent abroad; one New York firm had a contract to supply forty thousand skins of American birds to one Paris firm."

As to the pleasure derived from the presence of birds, John James Audubon fitly expressed the sentiments of thousands of people when he said: "The moment a bird was dead, however beautiful it had been in life, the pleasure derived from the possession of it became blunted."

There is a pleasure derived from the song of the birds, an education resulting from their fellowship, that makes their living presence greatly to be desired. These facts, and their utility when alive to the agriculturist, turn the scale greatly in favor of their protection and preservation.

How shall we accomplish this? I answer: By influencing public opinion and sentiment. The people have hearts; they have common sense and a love of the beautiful, and can appreciate the appeal.

Celia Thaxter is right when she says: "Evil is wrought from want of thought." The women of this city and of our country must combine their efforts along with those of the men, to stop the demand for birds' heads and bodies, by leaving off wearing the same, and by discouraging the use of the same by others.

As soon as the demand stops the killing will stop, as it is money paid to the shooters and trappers that causes them to take these birds and engage in this wholesale destruction of bird life. All wanton destruction of bird life should be frowned upon. We have a State law that prohibits the killing of many of our song and insectiverous birds, but we need the law to be enforced by public opinion. Above all, let the purchase of the birds' heads,

bodies, and, for the most part, of birds' wings also, be discontinued.

Right here, in closing, let me explain to you the Audubon Society.

The purpose of the Audubon Society is the protection of American birds not used for food. To accomplish this purpose it will:

1. Secure and publish information to show the extent of the present enormous destruction of birds for millinery, decorative and other purposes.

2. Expose the outrageous and indefensible cruelty of such wanton taking of feathered life.

3. Point out the damage to the agricultural interests of the land which must certainly follow the decimation of the insectivores.

4. By thus presenting the subject in its ethical, humane and economic aspects, enlist the sympathy and active personal co-operation of a large membership in the effort to check the evil.

Three forms of pledges have been adopted, viz.: 1. To discourage the killing of any bird not used for food. 2. To discourage the robbing of any bird's nest or the destruction of its eggs. 3. To refrain from the use of any wild bird's plumage as an article of dress or adornment.

The Audubon Society certificate of membership will be issued to those who subscribe to one, two or all the pledges. Membership involves no expense whatever. There are no fees of any kind. The funds necessary to carry on the work are supplied entirely by voluntary subscriptions, the immediate expense for organization being borne by the Forest and Stream Publishing Company. The society has local secretaries in cities towns and villages. The local secretaries will furnish circulars of information and pledge forms; will receive the signed pledges, keep a list of the members, forward a duplicate list with the pledges for enrollment and file at the society's office, and will receive in return certificates of membership, to be filled out and signed by the local secretary and given to the members. No certificate of membership will be issed to any person except upon the receipt of a signed pledge at the office of the society. Where no local secretary has yet been appointed, individual applicants for membership may address the society at its office, No. 40 Park Row, New York.

The society furnishes to each member a handsome certificate of membership. This bears a portait of the great naturalist, John James Audubon, after whom the society takes its name.

WM. HUBBELL FISHER.

CINCINNATI, May 25, 1886.

THIRD PAPER.

By REUBEN H. WARDER, Esq.

(Read May 25, 1886.)

To the Society of Natural History:

All observing lovers of birds, and students of Natural History, have noticed with increasing anxiety the prevalent fashion of wearing bird skins for the decoration of ladies' hats and gowns.

It is probable that this custom would never have become so general if the wearers of fine feathers had realized the great destruction of bird life, to which the fashion leads. In order to prevent the further wanton "Murder of the Innocents," many of the ablest and most tireless, true birdlovers have used both pen and voice in appealing to the public to stop this slaughter. Some theorists reply that this is all sentiment and go on to deny that there has been any diminution of numbers of birds; they assert that birds are the natural prey and food of man; that no special destruction effects their numbers; that birds will continue to exist in spite of all that man does until they give place to something better, and so on. We admit that figures are, from the nature of the case, difficult to get, and more or less uncertain. But the fact remains that in addition to the ordinary and unavoidable destruction of birds, by their enemies, by changed conditions of life and by man, that fashion has demanded the killing of very large numbers of birds, of various sorts, of the most useful and highly prized species. We hold that this killing can not go on indefinitely without effecting the numbers and disturbing the natural balance of creation, in which birds perform so useful a part.

And, as this fashion is a merely idle and useless one, and so injurious in its effects, we ask the help of all members of this Society, all well disposed persons, to aid the movement now in progress to discourage all wearing of feathers for decorative (so called) purposes. We called on all who are interested to form Anti Plum-

age Wearing Societies, and to aid the Humane Society in its efforts to lessen this evil.

Until recently, attention has not been generally called to this matter, but now that the American Ornithologists Union, Committee on Bird Protection, have been doing such good work in this country in publishing the facts of the case, there is more knowledge on this subject.

Mr. Bicknell says:

"So long as the demand continues, the supply will come. Law of itself can be of little, perhaps of no ultimate avail. It may give check, but this tide of destruction it is powerless to stay. The demand will be met; the offenders will find it worth while to dare the Law. One thing, only, will stop this cruelty—the disapprobation of fashion. It is our women who hold this great power. Let the women say the word and hundreds of thousands of bird lives every year will be preserved. And until woman does use her influence, it is in vain to hope that this nameless sacrifice will cease until it has worked out its own end and the birds are gone. It is earnestly hoped that the ladies of this city can be led to see this matter in its true light, and to take some pronounced stand in behalf of the birds and against the prevailing fashions.

It is known that even now birds are not worn by some on grounds of humanity, yet little is to be expected from individuals challenging the fashion. Concert of action is needed. The sentiment of humanity once widely aroused, and the birds are safe. Surely those who unthinkingly have been the sustaining cause of a great cruelty will not refuse their influence in abating it, now that they are awakened to the truth. Already word comes from London that women are taking up the work there. Can we do less? It needs only united action sustained by resolution and sincerity of purpose to crush a painful wrong, truly a barbarism, and to achieve a humane work so far reaching in its effects as to outsweep the span of our own generation, and promise a blessing to those who will come after."

FOURTH PAPER.

By F. W. Langdon, M. D.

(Read June 1, 1886.)

Mr. President and Ladies and Gentlemen—In response to the request of a number of members of the Society, I have decided to continue the consideration of the subject of "Destruction of our Native Birds," viewing the matter from a somewhat different standpoint from that taken by the committee, whose interesting and instructive papers we listened to with much pleasure and profit at our last meeting. It seems to me that the other side of this question should at least have a hearing.

I propose, therefore, to discuss the subject so far as my limited time and ability will permit, from what is at present—perhaps deservedly so—the *un*popular side.

The main proposition sought to be established by the reports of your committee, the committee of the American Ornitholigists' Union,* and papers of similar tenor by various individuals, is—

That our song-birds, insect-eating species and smaller birds generally, are in danger of suffering a notable decrease in numbers, or even extermination, by reason of—

First—The demands of fashion for millinery and dress ornaments.

Second—The bloodthirsty disposition of the "bad small boy."

Third—The market gunner, or "pot hunter."

Fourth—The ornithological collector and student.

It shall be my aim this evening to direct your attention to some facts which show the extreme improbability of any such misfortune resulting from either of these causes, or from any others at present within our knowledge.

In support of the claim that the demand for millinery purposes is the chief cause of an anticipated extermination of song-birds, we find numerous high-sounding figures in the various papers referred to. Let us see what these figures are and to what birds they apply. Mr. William Dutcher† states (quoted also by your committee), "that 40,000 terns were killed on Cape Cod in one season; that at Cobb's Island, off the Virginia coast, 40,000 birds," mainly gulls and terns, were contracted for by an enterprising woman from New

* Vide "Science Supplement," Feb. 26, 1886, No. 160.
† Ibid.

York, to ship to Paris; that 11,018 skins were taken on the South Carolina coast in a three months' trip of one dealer; that seventy thousand were supplied to New York dealers from a village on Long Island. Note, if you please, that these large figures apply to "*coast*" birds, mainly or entirely, therefore composed of gulls, terns and the "shore" birds.

My friend, Mr. Geo. B. Sennett, is also quoted in this article as stating that he overheard the agent of a millinery firm endeavoring to make a contract in Texas for ten thousand plumes of egrets (a species of heron, or fish-eating wader).

Then, in another place, is an estimate that the number of grebes shipped, mainly from the Pacific slope of North America, must range far into the tens if not hundreds of thousands. And my friend, Mr. Dury, has drawn your attention to the fact that the herons and other water birds have been destroyed by thousands in the swamps of Florida.

Now, the *argument* sought to be sustained by this startling array of figures is, that we are in danger of allowing the extermination of species desirable to man on account of their song, or economically valuable to the agriculturist as insect destroyers; and the poetical quotations and crude generalizations which are invoked to excite our sympathies are such as relate to these species—*i. e.*, song-birds. In other words, while in the statistics cited, mainly gulls, terns, herons and "shore birds" appear prominently in the foreground, the *moral* is pointed *chiefly*, if not entirely at "song-birds"—so that the non-ornithological reader is extremely liable to the impression that the figures themselves apply to "song-birds" as much as to any others, and to have his sympathies aroused accordingly. But when informed that these are almost wholly marine species—gulls, terns and "shore birds"—the scavengers of the ocean and ornithological tramps, so to speak, most of them being migrants, whose home is far beyond the confines of civilization; whose only "song" is a mere "screech or squawk," anything but musical to human ears, and which are not in any degree beneficial to man except for their feathers—*these facts considered*, does it *really* seem so bad to make merchandise of their plumage for ornamental purposes?

As for the destruction of thousands of herons and other water-birds in the swamps of Florida and Texas, this affects neither song-birds nor civilization, since their notes are no more pleasing than those of the gulls and terns; and they are doomed to extirpation

regardless of milliners and fashion whenever civilization drains and cultivates their nesting and feeding places. If we look at this part of the subject in an *economic* light, we shall see that these birds, chiefly herons, are the natural enemies of fish, so that their destruction, in the long run, directly favors the increase of food for man. Furthermore, their habitat is in districts entirely uninhabitable to the human species, and they would forever remain unknown to man but for the ornithologist, the sportsman and the milliner.

Now, leaving the gulls, terns, shore-birds, grebes and herons for the present, let us examine some of the figures of our pessimistic friends which *do* apply to *song*-birds and their use for millinery purposes. Here we are struck at once with the absence of definite figures, and in their place find such generalizations as "many song-birds" and "war of extermination" on catbirds, robins and thrushes.

One New York taxidermist is quoted as having thirty thousand skins of "crows, crow blackbirds, red winged blackbirds and snow-buntings." The first three species of disputed or doubtful benefit to man on account of their omnivorous diet, and with no song worth mentioning, excepting the clear whistle of the red-winged blackbird; while the fourth species is a far Northern sparrow, a winter visitor only in the United States, irregularly distributed, subsisting chiefly on seeds, and with no more song while with us than the European sparrows in our streets.

Again, the extent of territory from which this thirty thousand skins were derived is not mentioned—a very important item, as I shall hope to show later.

The most definite observations as to the use of song-birds are those by Mr. F. M. Chapman, as the result of *two* afternoon walks in the "shopping" districts of New York. He gives a list of forty species observed of which fifteen only can, by the most liberal classification, be denominated song-birds, including two sparrows, which are only winter visitors in the United States. The aggregate number of individuals belonging to this lot is stated at 174, which may be classified as follows: Song-birds and useful species, 30; useful but not song-birds, 38; birds of doubtful and negative value, 106. Amongst those classed as of negative value are some really objectionable as destroyers of useful species, namely, the shrikes and jays. The others in the negative list are chiefly terns, gulls, grebes and shore birds.

To this I may add my own observation, made yesterday, of a large wholesale milliner's stock in this city. Taking a dozen or two of boxes at random from the stock, here is the list: 24 tropical blackbirds (South American); 24 tropical orioles; 20 tropical king-fishers—habitat, Mexican border to Brazil; 12 troupials (South American); 6 large and very wicked-looking jays (not recognized as North American); 6 pigeons, of a species whose habitat is West Indies, Central an South American and Florida, hence locality uncertain, 12 white-shouldered blackbirds, *not* North American; 24 maroon tanagers—Brazilian; 6 heads of California quail; 1 red-shouldered blackbird; total, 137 skins, of which seven only are undoubtedly North American, and none of this seven song-birds.

I should not omit to mention the statement of my friend Mr. Dury, as to seeing "bluebirds by the bushel" in a taxidermist's stock in New Jersey. Now, Mr. D. does not say *how many* bushels, but we may suppose *three* bushels at one hundred skins to the bushel to be a pretty fair stock. Three hundred bluebirds killed in the State of New Jersey, with an area of 8,320 square miles, is equal to one to about every thirty square miles, and we are not assured that they were taken all in one season either. Does any one suppose this one blue-bird to thirty square miles would create a noticeable gap in the fauna? But how small are these figures, and how scanty the facts, as compared with those relating to the gull, terns, herons, &c. To be sure we find mentioned by Mr. Allen, and quoted by your committee, "the million of rail and bobolinks" killed in a single season near Philadelphia. These, however, have been destroyed annually for the benefit of Philadelphia and New York epicures for many years before bird-wearing came into fashion, so it is out of the question to charge their destruction to "bird-wearing ladies." And even with this formidable rate of destruction we do not see that either species has become extinct or even noticeably diminished in numbers. But suppose we consider, for the sake of argument, that birds are destroyed equally for millinery purposes—songsters and beneficial species along with those of negative value economically considered. To what extent are bird-wearers responsible for their destruction?

Prominent amongst the statements made in Mr. J. A. Allen's paper, and quoted by your committee in the use of birds for millinery purposes, is the assertion that ten million American women are of a "bird-wearing age and proclivities." Some might con-

sider this an exaggeration, which it probably is, but for the sake of a basis we will admit it to be true. Mr. Allen further estimates, allowing for the "making over" necessities of the economically-disposed ladies, that five million birds per year will be required to satisfy this demand.

Now, what effect practically, will this have on the bird fauna of America, for as two-thirds or more of the birds of any one North American locality are migrants, and many of them pass from South to North America, and *vice versa*, we must estimate the effect on the continent at large, as we do not limit the bird-wearing ladies to any one locality. Moreover, the ornithologist who attempts to identify the contents of boxes of bird skins in our millinery establishments will find the vast majority of exotic forms, as I have already noted. The ultimate influence of the destruction of birds then must be estimated by the number of birds in the whole country. Now, unfortunately for our purposes we have no reliable census of American birds, as applied to individuals, but, following the example of Mr. Allen, we may *estimate* that the 15,000,000 square miles, comprised in North and South America and the West India Islands, will average at least two hundred birds to the square mile (and I think my ornithological friends that are present will agree with me that this is an exceedingly moderate estimate).

According to our estimate, then, we would have a bird population in the Americas of 3,000,000,000—(that this is not an excessive estimate is evidenced by the fact that Alexander Wilson computed the number of pigeons alone in a single flight at over 2,000,000,000)—or 1,500,000,000 pairs. Now, another very moderate estimate would allow at least two birds *per annum* to each pair for natural increase; so that 3,000,000,000 birds must be destroyed annually, by all causes, in order that the bird fauna shall remain at its present proportions; in other words, until that number are destroyed there will be no decrease in numbers. Now, the proportion destroyed for millinery purposes taken at Mr. Allen's estimate of 5,000,000 and allowing another 5,000,000 for South America, Canada, Mexico and the West Indies, would be as 10 is to 3,000, or as 1 to 300; the other 299 meeting their death from other causes. In other words a mortality rate of 3 1-3 per 1,000, while a rate of 20 to 25 per 1,000 in the human species excites no comment whatever.

The actual rate in the birds is manifestly much less than that above stated, since a section of the country with only 200 birds to

the square mile would probably be the rare exception rather than a frequent occurrence.

Be it noted, furthermore, that the constant demand for novelty, to which fashions are due, prohibits a continuance of even this low mortality rate for many years in succession.

Figures aside, however, it is a self-evident fact that all species of animals and plants require checks to their maximum rate of increase. (The human population of the United States, at the ordinary rate of increase, would number four to every square yard of the earth's surface in less than seven hundred years).*

Now, of the many natural checks upon the increase of birds, some are removed by civilization, others are increased.

Then again, there is even a higher factor that governs the increase or decrease of different species—which is unknown to us except by its effects, namely, the inherent capacity of the species itself to increase.

As an instance of the disappearance of a species without known cause, we have the case of own parroquet, a bird abundant in large flocks, throughout the Ohio Valley in the first quarter of the century, noted by Audubon in 1831, as rapidly diminishing in numbers; by Kirtland and others, in 1838, as only met with irregularly, and as straggling flocks. While we have no recorded date of their appearance in this State, between 1840 and 1862, when a single flock of stragglers were noted in Columbus.

Throughout their range we have the same accounts of constantly diminishing numbers, as we had before the days of bird-wearers, taxidermists, pot hunters, or ornithological collectors in the West. In accordance with this capacity some species are to-day increasing, while others are dying out, much as they did in former geologic times before the human biped made his appearance; and man to-day is only one check upon species, in Nature's vast game of chess; and not by any means so important a one as he is apt to imagine.

To sum up, then, the practical influence of bird-wearing upon our fauna, we may note :

First—That the North American birds used in greatest numbers are gulls, terns, herons, and others, *not* song-birds, nor species beneficial to the agriculturist.

Second—That our most desirable and familiar song-birds, such as thrushes, wrens, greenlets and finches, are in limited demand, on account of their generally plain colors.

* Darwin, "Descent of Man," p. 126.

Third—That of the briliantly plumaged birds, a vast majority come from South America, and other foreign countries.

Fourth—That probably enough of shrikes, jays, crows and other predatory species are destroyed to more than compensate for the few song birds actually killed by man for all purposes.

Fifth—If all were song-birds and equally beneficial the reduction in numbers from this cause would be inappreciable in its effects on the fauna of the country at large.

Coming down to the consideration of the birds of our own locality and surrounding territory, Mr. Dury has given us a very interesting reference to the abundance of the wild pigeon in this region twenty-five years ago, and has noted their scarcity at the present day. The last great flignt of these birds that I remember here was in the fall of 1865, when the air was darkened with them for the greater part of two days.

Now, *their* disappearance is certainly not due to the demands of the milliners; and while the pot-hunter and the "bad small boy with a gun" have probably destroyed their share, much more influential factors in causing their disappearance in my opinion have been the demands of agriculture and commerce, causing the destruction of the mastbearing forests where they fed and nested. The same factors account mainly for the disappearance of our larger game and water birds—*i. e.*, clearing forests, draining swamps and so on.

And we might as well attempt to stay the progress of Old Father Time himself as to check civilization in order to save these birds. "But, it may be asked, must our civilization eventually cause a birdless country?" Not by any means; on the contrary, we shall find if we study the comparative abundance of birds *in general*, in most civilized sections of our country, that birds are probably more numerous, both in species and in individuals, than they were in the earlier days of its settlement. On this point I will take the liberty of quoting from an article by myself in the Journal of this society for 1879:

"During the past forty years several important changes have taken place in our local bird fauna. As in all thickly populated districts the wild turkey and prairie chicken have been exterminated; the parroquet, which formerly occurred in abundance throughout the Mississippi and Ohio Valleys has at present a much less extensive range, being mainly confined to the Gulf States; the beautiful swallow-tailed kite (*Elanoides forficatus*) has apparently

ceased to visit us, and our two largest woodpeckers (*Campephilus principalis* and *Hylotomus pileatus*) have disappeared along with the dense forests that were their favorite resorts. The seventh extirpated species is the raven, which is said to have been a common resident of this section in former times.

"To offset these losses we have the cowbird and the black-throated bunting in abundance, both of which were considered of doubtful occurrence in Ohio forty years ago; the Kentucky warbler, loggerhead shrike and lark finch are also inferred to have made their appearance within the same period, as they were omitted entirely from Dr. Kirtland's list; and the cerulean warbler, now a common summer resident throughout the State, was observed by him in one instance only, a fact strongly suggestive of its comparative rarity at that time. Within the present decade two European species, the house-sparrow and the sky-lark, have also been added to our fauna, the former of which seems likely to exceed in numbers any one of our native species, unless its extraordinary increase should be checked by natural or artificial means—a consummation devoutly to be wished."

"The foregoing are doubtless but a portion of the changes in the Avian-fauna of this locality within the period mentioned, as many others, of which we have no definite record, have probably taken place; it is apparent, however, that the various conditions attendant upon civilization have resulted, directly or indirectly, in the extirpation of several of our larger species; while, on the other hand, there has been a decided increase both in species and in individuals, among the smaller birds. And finally, in these various changes that have occurred in our Avian-fauna, we have an excellent illustration of the workings of that universal law of nature, in accordance with which the living things of a country or district become adjusted to their surroundings; protection from enemies and an increased food supply, resulting in a greater abundance of some forms, while extirmination is the fate of others whose habits or constitutions will not admit of the modification necessary to adapt them to new conditions."

Instances might be multiplied to show that civilization and cultivation of the soil favor the increase of small birds, and the reasons for this are obviously: First--That the clearing away of forests and introduction of new seed and fruit bearing plants, which are also the food of a host of insects, directly favors the increase of food for small birds, both seed and grain eaters and insect feeders.

Secondly—The destruction of the larger birds of prey, and predaceous mammals, such as weasels, wildcats and other bird enemies likewise operates to permit the increase of small birds. Thirdly—The providing of better protected nestingplaces, such as barns, bridges, cornices, bird-boxes and so on, insures a lessened mortality among many small birds, e. g., wrens, bluebirds swallows, &c., in their immature state."

Another phase of our subject which has been lightly or not at all discussed by your committee, is the relation of ornithological collectors and students to the destruction of birds. Possibly, some members of the committee, like myself, have felt the reproval of a "guilty conscience," and were willing to let this part of the subject be touched as lightly as possible. But John Burroughs,* one of our most beautiful writers on birds, of the purely sentimental class, has attacked "the collector" and "ornithologist" with quite as much *vim* and savage denunciation as the members of your committee have bestowed upon the pot-hunter, the small boy and the milliner —and perhaps with quite as much reason, from *his* standpoint. But *fact* is of more value than *sentiment* in scientific matters. Suppose, therefore, we look at some of the *facts* in connection with this part of the subject. In round numbers two-thirds of our birds in this locality are migratory, and consequently are shot by collectors over a wide extent of territory.

To illustrate this problem then we will cite a few figures, as they apply to the neighboring States of Ohio, Indiana and Kentucky. These States, with an aggregate area of 112,000 square miles, contain forty-two registered collectors, according to the naturalist's directory. Now, allowing an increase of 100 skins per year to each collection, (and this is certainly a very liberal average) we have 4,200 birds taken affecting 112,000 square miles; in other words, one bird to each twenty-seven square miles. Does any one suppose this will make a noticeable diminution in their numbers? And even here we leave out of account the small birds *saved* by the removal of shrikes, jays, hawks, and other rapacious birds.

If these things *were* considered the "collector" would perhaps even have a small balance in his favor, aside from the obvious fact that it is to the "collector" and "ornithologist" that "sentiment" owes its knowledge of our birds; but for him hardly one in ten of our species would ever be known to exist, and the songs, habits,

* Century Magazine for 1885.

structure and other peculiarities of hundreds of species would remain forever unheard and undescribed by man.

Even the destruction of birds by the much execrated small bad boy with a cheap shotgun is not without its mitigating features. For example, Spencer F. Baird, the present head of the Smithsonian Institute and U. S. National Museum, was, in Audubon's time, one of these "small boys" possibly as wicked-appearing as any. And even of the illustrious Audubon himself, we read, in his boyhood days, that "supplied with a haversack of provisions, he made frequent excursions into the country, and usually returned loaded with objects of natural history, birds' nests, birds' eggs," and so on. Now, it is not to be supposed that all amateur boy ornithologists will develop into Audubons, Bairds or Allens or Coues or Ridgways and yet no one who considers the subject in its broader bearings can ignore the fact that the concentrating of the mind upon so attractive and instructive a subject as the study of birds, must have, in the long run, an elevating and refining tendency; and in any event boys might be in much worse mischief, both bodily and mentally.

We may dismiss the small boy then, with the remark that he has as much right to the gratification of his developing taste for ornithology as the more pretentious collector who may have the means and inclination to employ a dozen or two small boys in the interest of his collection.

As regards the purely humanitarian view of the subject, if we are going to condemn the wearers, or collectors of birds on the ground of discouraging "cruelty to animals," we must also, to be consistent, oppose the *scalding alive* of myriads of embryo winged creatures, in order that humanity may wear silks and ribbons, and object to sealskin garments, because the poor, innocent animals are butchered by thousands on Alaskan Islands with no chance for resistance or escape.

But our subject is too large and our space too limited to permit us to even touch upon all its bearings.

Now, ladies and gentlemen, I would not have you suppose, for a moment, that I am an enemy to our birds; on the contrary, some of the pleasantest hours of my life have been spent in their company.

Neither do I believe in the extravagant statement quoted by one member of your committee, that the "United States are going raight to the desert condition of a country without song-birds."

Such exaggerations and inferences as that defeat their own purpose; and to refute them, it is sufficient, in my opinion, to cite the practical fact that no song-bird is known to have become extinct, or even materially lessened in numbers, over any wide extent of our country, and where they *have* become diminished in limited localities, it has been chiefly due to the introduction by a lot of well-meaning but misguided sentimentalists and ornithological cranks, so to speak, of a foreign species (the European sparrow), which pre-empts their nesting places, eats up their food, and otherwise increases at their expense, so that they are forced to seek a home elsewhere.

Another cause of decrease in some localities—and a *preventable* one—is the removal of their favorite abiding-places, such as thickets and shrubbery. Where this is not done there is no reason—aside, perhaps, from the European sparrow—why our suburbs and country places generally should not possess more song-birds than they ever did in the early days of the country's settlement.

While, therefore, I am in favor of the increase of desirable birds, of the utmost dissemination of knowledge respecting all birds, of the formation of Audubon Societies, if you please, and of the popularizing of ornithology in general, I do not think we gain anything in a scientific or practical sense by distorting, misstating or suppressing facts, exaggerating figures, or by denouncing the well-established right of man to use all natural objects for the furtherance of his necessities, his convenience, or his pleasures.

In concluding, ladies and gentlemen, let me say to you that my remarks this evening are merely a few random notes and comments upon a subject of vast extent. And if I have succeeded in directing your thoughts to a few of its important relations to humanity and the rest of animated nature, I shall have accomplished my present purpose.

FIFTH PAPER.

By Mr. Chas. Dury.

(Read June 16, 1886).

Ladies and Gentlemen—When requested by the Lecture Committee of this society to prepare a paper on the destruction of native birds, I did not understand that the object was simply to speak of song-birds, as popularly restricted, but that all birds were to be considered that merit our protection (and what birds do not?) Some of the statistics presented were those offered by the most eminent observers and ornithologists of the East. And far from their being exaggerations, the fact is the truth has not been half told. The absence of sea birds from their former haunts is sooner noticed than the absence of forest birds, and statistics are easier to obtain. Though, in regard to other birds, they are neither want ing nor unreliable. In the paper referred to above I might have brought forward many more facts and statistics had I supposed any one would have disputed the point or questioned the advisability of doing everything that could be done either by the force of public opinion or legislation to protect our beautiful and persecuted birds. The report comes from all parts of the country of the decrease in the number of native birds. Mr. Allen writes me:

"We are receiving letters from everywhere, deploring the decrease of small birds, showing their decrease is a fact so palpable as to attract the attention of very many of our correspondents living at widely separated localities." I should be loth to believe that these persons, many of them eminent in science, have either exaggerated or falsified. The effects of such a paper as the one read at the last regular meeting of the society must be most pernicious. A person at the meeting was heard to remark: "We need not feel so badly after all about it." "A wink is as good as a nod to a blind horse." Create a market for our birds and relax the frown of public opinion and they are gone. The protectors of game and other birds have an almost impossible task to perform, and with protective laws (whose language can not be misunderstood) on the statute books of nearly every State and Territory in the Union, the numbers of our birds are found growing less each year.

Dr. Langdon in the paper referred to estimates the number of birds in the Western Continent, with fifteen million miles of area,

at two hundred birds to the square mile. Or, to bring it more within our comprehension, the two million square miles of area in the United States, with its two hundred birds to the square mile, and we have four hundred millions as the total number of birds in the United States. He does not say if this guess is made up from the migratory season, or the average residents during the year. I presume, however, it is the latter, and according to this method of computation he figures out that birds double their numbers by natural increase each year—a stupendous counting of chickens before they are hatched. As there are absolutely no statistics on this subject, this is in the nature of new information to ornithologists. There is a large extent of country in the United States almost destitute of birds.

During the winter the great plains extending from Texas up to the British Possessions are destitute of bird life, and even in summer birds are very few and far between. I have traveled all day over the desert country of New Mexico without seeing a bird, and it is only when one comes near water that birds begin to appear. In traveling through the Rocky Mountains, and also through the mountains of West Virginia in the summer, I was astonished at the small number of resident birds. Dr. Freeman and myself observed the same condition in the dense pine forests of Michigan, and that, too, in summer, when birds should have been most numerous. Back from the Nipegon River the fishing parties of the Cuvier Club report the country an avian desert, as I also found other parts of Canada back from the St. Lawrence. The vicinity of this city is one of the most favored localities in the land for birds, and by comparing local lists it will be seen that there are but few places comparable with it. I mention the above facts to show how impossible it is to even guess approximately at the number of birds in the area given. Dr. Langdon deprecates the want of facts and reliable statistics in the paper read by your committee and then proceeds to reason from a theory based on such guess work as this. Nor does he make due allowance for the tremendous destruction from natural causes which threaten the lives of birds at every stage of their existence. Elliott says: "Birds that return in spring are not more numerous than those which came the preceding spring; whereas, those that went back in autumn were two or three times as numerous." Dr. Langdon states that man is but one of nature's checks to the undue increase of birds.

Man is an unnatural additional exterminating check. J. A. Allen says: "Whatever man does to destroy birds is purely a drain upon the supply of bird life, added to the natural checks by which nature keeps the balance even, and is disturbing and destructive just in proportion to the extent to which it is carried, and for which nature has no means of compensation."

Against the killing of food birds under proper restrictions, or killing birds for any scientific or educational purposes, I have nothing to say, but to shoot a beautiful and harmless egret, that the few plumes that grow on its back may be used to make a grotesque hat or bonnet look still more grotesque is certainly a very bad economic proceeding, to say the least. If the idler who shoots for food the robins, thrushes and other song birds, as is largely done in some of the Southern States, would devote the price of the ammunition and the time it takes to shoot them to procuring some other kind of food he would quicker stock his larder.

If the growers of small fruits are not willing to compensate the birds for the benefits they confer on him in the destruction of injurious insects by giving some fruit, then he has a right to shoot them or drive them away. When a lot of cedar birds or robins come into one of my trees of choice cherries the way they gobble up cherries makes me tired, but it would be very bad policy to shoot them for it. As the old English farmer said. "Surely I can well afford to give a penny's worth of fruit for a shilling's worth of song."

Dr. Langdon says that any effort of man would not make any appreciable difference in the numbers of our song-birds, and that if this Government would appropriate a million of dollars to exterminate them it would make no difference in their numbers. This is a most extraordinary statement. Let us see what man's ability as an exterminator is.

Perhaps the earliest job of bird extermination of which there is any evidence was the destruction of *Æpiornis maximus.* While the natives of Madagascar assert that a few of these gigantic birds remain in some of the most secluded parts of the island, yet the probability is that they are totally exterminated, and without doubt by the hand of man, as the famous French traveler, Alfonse Grandidier, emphatically assures us.

The Moas of New Zealand were exterminated by man at a comparatively recent period. The "Dodo" (*Didus inceptus*), the great pigeon of the Mauritius, became extinct about 1693, killed

by man and destroyed by the dogs and hogs which the Dutch had introduced on the island in 1644.

The Capercaili became extinct in Scotland, but has been re-introduced and an effort is being made to protect and increase them.

The great Auk (*Alca impennis*), the celebrated "wingless bird," as it was called, was the next. A bird famous because of its tragic fate. It bred numerously on Newfoundland and the Funk Island during the last century. In 1844 the last survivors of the last colony in Iceland were killed. Now its skin and bones are regarded as the most precious treasures of the museums. Mr. Robert L. Stuart bought one for $625 and presented it to the museum in New York. These birds were unable to fly, hence the destroyers made short work of them.

If we refer to the animals, man's reputation as an exterminator will not suffer either, for one of the most familiar instances is the American Bison, that ranged the great plains of the West for untold ages, hunted by the Indians, who used its flesh for food and its skin for shelter, without any great dimunition in its numbers. The white man came upon the scene and slaughter was the order of the day. The grand but harmless animal is gone; its snow-white bones tell the story; a disgrace to American civilization. I now propose to show how man is decimating certain species of birds and has practically exterminated them over given areas. The most startling case is that of the wild pigeon, mentioned before by one of your committee. Dr. Langdon says this bird's destruction is due to the clearing the country of mast bearing trees rather than destruction by man. Undoubtedly man destroyed the trees, but this is not the principal cause, as only a portion of the mast bearing trees are destroyed, and any failure of mast simply caused the pigeons to move to a more favored locality. A flight of a few hundred of miles is nothing to such a bird. The grain that grows in the fields cleared of mast bearing trees compensates for the mast destroyed. In the Southern States the bird fed largely on rice. More rice grows in the Carolinas to-day than in the time of the wild pigeon. Along the Nipegon River, that comes down into Lake Superior from the North, the pigeons formerly came to feed on the berries that grow there. The berries grow there just as abundantly now, but the pigeons do not come to feed on them. In regard to the almost incredible numbers of the pigeon, it is interesting to trace their gradual diminution from the time of Wilson

and Audubon to the present day. D. G Elliott, in speaking of the birds' arrival at the roost, says:

"The arrival of this great host is an impressive sight. Long before their crowded ranks appear their approach is heralded by a sound resembling the rising of a gale of wind, increasing in loudness until they hurl themselves into their chosen nightly abode, when the din caused by the flapping of myriads of wings, the struggle for a place on the trees, the constant change of position and the crashing of over-loaded branches, is so completely overpowering that not only the human voice cannot be heard, but even the discharge of a gun would pass unnoticed. At one time pigeon roosts were not uncommon in the United States, but they are gradually disappearing, for the wild pigeon, like all other game, from lack of wise and requisite protection in the United States is being brought slowly, but surely, to its final extermination."

Colonel Harris, President of fhe Cuvier Club, with Mr. Benj. Robinson, has fished at Kelly's Island, Lake Erie, every spring for many years. Last April while there they did not see a robin, bluebird or thrush during their stay on the island, where they formerly saw many. In cruising around fishing, and particularly on the shoals where they caught their minnows for bait in former years, they saw flocks of gulls and terns, and particularly were terns very numerous, flying in flocks of hundreds, yet this season two or three were the most they saw together. They were informed by residents that there had not been more shooting than usual, but the birds had been killed before they got there. Mr. H. C. Culbertson, however, informs me that the scarcity of song birds on Kelly's Island is due to the residents, who turn out at the time the grapes ripen and shoot these birds, imagining they eat some of the grapes—by killing them for several years, the regular migrants become exterminated, and it is only by fortuitous circumstances that any birds get to the island. Here is an instance where man exterminates the birds over a given area; apply the same methods to a larger area and you would have the same results.

In 1884, Mr. Warner, a bird dealer of New Orleans, shipped over ten thousand nonpareils to different points, mostly to Europe. In 1885 he was only able to obtain four thousand for shipment, and this season (1886) he had an order from a dealer of New York for five hundred, and all he could furnish him was two hundred, so great was the scarcity of birds, and the consequent utter failure of his bird catchers to secure them.

In 1885 Mr. Klepper, in talking to the shippers of Cuban parrots, asked them what causd them to be so late in getting into port with their birds, and why the prices had gone from twenty-one dollars to thirty-three dollars per dozen. They informed him that the cause of delay and the higher price was due to exterminiation of the birds in their old haunts, and that they were obliged to go many miles into the interior to find any, and in speaking of the destruction of the mocking birds in the South he said: "When at New Orleans last season I went out to a suburb where I used to go to see and listen to the mocking bird. To my dismay when I got there I did not see a bird. On inquiring I was informed that the bird catchers had cleaned them out in that locality." Mr. Klepper also said of the cardinal grosbeak: "Formerly, I used to receive these birds in large lots of from fifty to one hundred, but now I never see over two or three in a lot, so few, in fact, it does not pay to ship them. In the case of the nonpareils above mentioned, nearly all were males caught with a call bird when the birds were full of song and fight, just previous to the breeding season. Does any reasonable person pretend to say that 10,000 male nonpareils handled at such a time by one person, (to say nothing of the thousands handled by other dealers), would make no appreciable difference in the numbers of this bird? Mr. Alex Starbuck, of this city, was in Los Angeles, Cal., last winter, and while there he visited a taxdermist, Mr. Whately, who showed him an order he was trying to fill for a lady, (one of the angels of the place I presume.) This order was for enough small owl heads to trim a dress, with a row up each side and a row around the bottom. It took over sixty to do the job, Whately had got stuck, as the supply of owls in that locality had given out.

I presume when Flora McFlimsey saw this unique dress she would mentally resolve, if there were owls enough left, she would beat that dress or bankrupt herself. I have had orders for owl's heads to be worn on bonnets. I sold a lady an owl's head for her bonnet, she paid me the price of the entire bird for its head and I had the body left to sell to somebody else. When fashion gets after the poor owls may the Lord help them.

Mr. Starbuck speaks of the great scarcity of small birds through the South (in localities visited by him) as compared with former years, he says since guns have become so cheap and easy to obtain, the birds have rapidly lessened in numbers, and the Superintendent of the Sportsman's Shot works of this city informed him

that more shot was shipped to Kentucky by them, than to any other State, for nearly every man and boy has a gun, and they bang away at every living creature.

Mr. Starbuck also mentions the Pacific coast, and speaks of the Chinese as being the most skillful bird-trappers in the world. He says they catch and eat everything in the shape of a bird. In making inquiries of taxidermists and bird collectors as to the cause of the scarcity and great decrease of the birds there, they imformed him it was due to the enormous numbers killed by sportsmen, collectors of birds and their eggs, and shooters generally, for California has supplied the world with the peculiar fauna of the Pacific slope.

The migration of birds is not thoroughly understood, but enough is known to show that the migration movement is not a pell-mell headlong rush without an object, except to change location; but an orderly, systematic, intelligent movement actuated by that grandest and most wonderful incentive, the perpetuation of the species. That birds come back to the same spot where they reared their broods the year before, bringing their young with them, is well proven. "Migrating birds have an inherited talent for geography," as Weissmann happily expresses it. Peculiarly marked birds run the gauntlet of their innumerable enemies and come back several years in succession to certain spots. Thus we see that birds that migrate up the Ohio Valley do not mingle with those that pass up the Upper Mississippi, except at the point in the South where they pass the winter. Consequently if the fittest survive the many checks to their increase and return to their nesting ground to be there persistently persecuted and killed, then that locality will soon become destitute of bird life. That man, by friendly advances and protection, can increase the number of birds in a locality can be easily shown. Twenty-seven years ago when my father moved to our present home place in Avondale, there was but one stunted tree on the place, it being a meadow. The only bird I saw there on my first visit was a meadow lark (which I foolishly shot, and got a terrible raking from the old gentleman for doing it). The place was soon thickly planted with trees and the birds began to appear, until I have recorded up to June, 1, 1886, 114 species, ranging from one to many individuals of each species. If it is in the power of man to so largely increase the numbers of birds in a locality, why could he not decrease them?

Dr. Langdon speaks of having examined the stock of birds of a wholesale millinery house in this city and having failed to find any song birds in them. I called on perhaps the largest dealer in this line of goods in this city, a gentleman who has had thirty years' experience in the business, and perhaps knows more about the trade than any other, and he told me as follows: "This is the wrong season of the year to find many birds in stock.

"In the better grades of goods you will not find so many native birds. It is in the cheaper stocks that they come, because they are put up in immense lots and can be sold cheap. While we handle the higher priced goods, yet we have had thousands of native birds and feathers of all kinds, such as robins, meadow larks, jays, &c. Egret plumes are very high and scarce, as the birds are nearly exterminated and we can't get them. Paradise birds are very high and becoming scarce. I have seen them sell for from two to three dollars each, and now they bring eight to ten dollars. The wing of one species of dove suitable for dyeing has gone up from six dollars per gross to sixteen dollars per gross. The dealers around New York collect all the time, for if a kind goes out of fashion they lay them away until they are wanted again."

A lady showed me a barn-swallow she had bought for her hat, and for which she paid fifteen cents, and the store where she bought it had boxes full of them—"Your choice for fifteen cents each." They said they were selling them out cheap, as they were overstocked. I went up to this store to count these birds (fearing lest this might be set down also as an exaggeration). They told me that it was out of season and their stock was packed away. In regard to the New Jersey dealer before mentioned, I did not count his stock of native bluebirds. Dr. Langdon, however, supplies me with their number from his never-failing stock of figures; it was three hundred, or one to thirty square miles. Now, for fear of exaggerating, I presume he fails to speak of the many other dealers and collectors in New Jersey of whose stock this one was only a sample. Mr. Allen says in a letter, before referred to: "Judging by what we see in the East in the cities and towns generally, two-thirds of the birds in point of numbers, used for hats, are our native song-birds."

If the efforts of man are of no importance in the destruction of birds, as Dr. Langdon would have us believe, what an immense amount of valuable time and thought has been wasted in legislation

in passing laws for the protection of birds, not only in this country but also in Europe. The law is so severe in some parts of Germany that for the second offense in destroying a nightingale the punishment is imprisonment in the penitentiary, the punishment for the first offense being a heavy fine; while to keep a nightingale in a cage one has to pay a license.

France, better than any other country, shows the result of man's destruction. In traveling from Mt. Cenis to Paris I did not see any birds except a few sparrows, and even these were scarce and shy, and in the parks and other places where birds are protected, the only wild birds observed were a few wood pigeon and sparrows. In Italy, outside of the gardens and parks, birds were very scarce, caused by the enormous destruction carried on by the inhabitants, who eat up everything from a least titmouse to a hawk.

Skylarks are regarded as a great dainty in Europe. Statistics inform us that over five millions were brought annually into Leipzic, and into the little town of Dieppe, France, the official returns state that during the winter of 1867-68 one million and a quarter were taken. I suppose Dr. Langdon, by his methods of multiplication, would figure out that the destruction of this vast number of birds would make no appreciable difference in the quantity in the vicinity of these cities.

The paper under consideration, in endeavoring to prove that birds are becoming more numerous in this locality, mentions several species in support of the theory, prominently the Cærulian wrabler and the quail. He states that the Cærulian warbler was but once observed by Dr. Kirtland, therefore it was *not* here at that time. He further stated that it is now the commonest warbler we have This warbler is a forest bird, and frequents the tops of forest trees, and moreover, is very small, so that Dr, Kirtland may have overlooked it (as I did myself for several years.) It being essentially a forest bird, the clearing of forests would rather diminish than increase them. I found them common one season in Clermont County, but not nearly so abundant since. In Avondale it has always been an uncommon bird, and not nearly as abundant as several others of the *Sylvicolidæ*. This last spring (1886) I failed to either see or hear a single one.

Dr. Kirtland speaks of this species in 1838-1841, and again in 1852, so he must have seen it oftener than the single time, as

stated. I should therefore consider it extremely doubtful if it was not as abundant fifty years ago as it is now.

Another bird mentioned as increasing is the quail, though in the newspaper report published all mention of this species is eliminated. Dr. Langdon quotes from "Nests and Eggs of Ohio Birds" to show that under the tender mercies of the pot-hunter, market shooter, quail trapper and other concomitants of civilization, the quails are becoming more numerous, when such is notoriously not the fact.

A partial civilization is undoubtedly favorable to the increase of quails. Alternate fields and woods, with dense thickets for cover, are the favorite haunts of these birds, but a high state of scientific farming is fatal to them, as was forcibly brought to my notice. About twelve years ago I hunted quails northeast of Glendale, and though we found many coveys, we got but few birds, as they flew into the dense thickets and briers, where they were safe at least from our guns. Three years ago I went over the same ground and found the farmers had improved their methods of farming. and cleaned up the briers and thickets, while the hard winters, shooters and vermin had cleaned out the quails, for we failed to find any. In the last twenty years the price of quails has more than doubled.

I have interviewed some of our most experienced sportsmen, and they all say quails in this State are becoming very much scarcer. Mr. N. A. Crawford, a farmer near New Baltimore, Ohio, informs me that he had only seen one or two quails on his farm in the last three years, whereas in former years he had several large flocks on the same ground. These facts do not point to the increase of quails, as Dr. Langdon endeavored to show.

In regard to the cowbird, black-throated bunting, and the other species mentioned as being absent from this locality forty years ago, because they were omitted from a local list is an inference drawn from very slender evidence.

I do not think anyone would urge the destruction of their food, as the cause of the rapid decrease in the numbers of the pinnated grouse. Where I hunted them at Odin, Ill., some years ago, I saw many, but they are now nearly, if not quite extinct, in that locality.

In 1872, I hunted the same bird at Kennekuk, Kan. I could easily bag as many as I could carry, and saw flocks numbering

hundreds of individuals. Now, a relative recently from there, tells me the prairie hens are nearly all gone from that locality.

The statement that our most desirable and familiar song-birds are not in demand on account of their plain colors is a distortion of the facts in the case. I was once offered an order at good prices either in cash or in exchange for South American birds, for as many scarlet tanagers, Baltimore orioles, yellow-breasted chats, indigo birds, bluebirds, cardinal grosbeaks, wood-thrushes, robins, brown thrashers and meadow-larks, all of which are our most valuable and familiar songsters, and nearly all the brightest colored of our birds. In fact, the letter stated that almost anything could be used in almost unlimited quantities. It is a mistake to suppose that brilliant color is the only desideratum in birds for hat decoration, for the plumage of the peafowl (one of the most brilliantly colored birds in the world) is not used as much as some of our more plain coated songsters.

In regard to the omnipresent small bad boy we must agree with Dr. Langdon, that he *might* be in worse mischief than robbing bird's nests and stoning birds (a study of ornithology undoubtedly has an elevating and refining influence, and was never complained of by your committee), and we would not entirely suppress him (in an ornithological sense) either for fear of depriving the country of some Baird, Audubon, Allen or Ridgway. Yet it might be difficult to convince our surburban residents, who love and protect birds, that the plundering young urchin's gratification in developing his taste for ornithology with rocks and pea-shooters is in any way conductive to science.

Mr. H. Wilson Brown, who told me recently how some robins had attempted for two years in succession to rear broods in the shade trees in front of his house, but each time the boys had destroyed the nests, and that one disciple of the pea-shooter was seen in the neighborhood with thirty-five fresh birds eggs in his possession, as the result of one morning's foray; or the Rev. Mr. Rishell, who brought me a mangled wood thrush, shot from her brood near his door by one of the above mentioned disciples, who was thirsting after ornithological knowledge—these gentlemen, I fear, would consider this more partaking of cussedness than science.

There are about twenty-five persons, mostly boys, who collect birds' eggs in this vicinity, and who systematically hunt for nests and eggs, and in most cases the sole object seems to be to get more

eggs than somebody else, just as boys collect buttons and postage stamps. These collections aggregate ten or twelve thousand eggs, perhaps one-half or two-thirds being from this immediate vicinity. I think also the egg collector is on the increase. I therefore conclude that the small boy is a formidable competitor with the domestic cat as a bird enemy in thickly settled suburbs.

The summary disposition of the "ornithological tramps," as this paper (which has so high a regard for scientific accuracy and such a poor opinion of sentiment) styles the egrets, herons, gulls, terns and shore birds of use for nothing but their feathers!—a direct waste by nature of so much raw material. I am glad most lovers of nature have enough sentiment in them to see other and far more important uses for these beautiful birds than a few feathers.

In conclusion, I would say, at the last meeting of the society I was asked if I had noticed any great diminution in the numbers of our small birds. I replied no, but my observation was confined to a place where birds are somewhat protected, in the woods. This spring I found but very few birds, but attributed it to seasonable influences. As my own observations had covered so small an extent in 1886, I have interviewed quite a number of persons interested in birds, and persons whom I knew to be accurate and competent observers. Their answers were, invariably, birds are much scarcer than they were some years ago.

Mr. Cliff Allen said that in Glendale, near the park, birds were, he thought, about as abundant as ever, but outside the village their numbers had decreased to a marked extent - particularly so were the red headed woodpeckers, which the boys had used as a target for their guns. Mr. W. A. Clark, President of the Wyoming Shooting Club, stated that in the towns where birds were protected they had not decreased, but in the country around he noticed their much diminished numbers.

SIXTH PAPER.

By Wm. Hubbell Fisher, Esq.

(Read June 16, 1886.)

Ladies and Gentlemen, fellow-members of this Society, we have assembled to discuss a very interesting subject, pregnant with influence for good or evil to the farmer, the horticulturist, the fashionable classes of our land, and to all who love and enjoy our birds and their melody of song.

Our first meeting held under the auspices of this Society, on evening of the 25th of May last, grew out of an appeal from the Audubon Society. This Society was begun in New York City in February of this year.

What is the object of this Society? Its purpose, as it states, is the protection of American birds, not used for food, from destruction, chiefly for mercantile purposes.

How came this Society to be? Because the leading ornithologists of America, in the American Ornithologists Union, discovered that an immense number of our native birds were every year destroyed. The majority of these birds thus killed were used to trim hats, muffs and dresses; sometimes the wings, but oftener the head and body.

Fellow-members, I intend to discuss this subject broadly, and to base what I have to say upon facts of science and upon such well known facts belonging to our nature, that shall, I trust, convince you that it is now desirable to create a public sentiment in favor of the protection of our birds.

Of what avail is any science? Certainly a science confers most benefit upon a commonwealth, just so far as it most contributes to the economies and substantial welfare of the people.

It will be observed that the question I discuss to-night does not include the birds used for food.

Organizations, like our Cuvier Club, are found in every large city, who contribute their money and use their influence to secure proper protective legislation for the preservation of the game of our country, and to prosecute the offenders of such laws.

So we can, as the Audubon Society does, well afford to leave the care of game birds in the hands of their organized protectors.

But, alas, the other birds have had but few to act for their

protection. On our Statute book there is a law making it unlawful to kill a certain few of them, but it is practically a dead letter.

Did you ever see a law enforced when nobody was interested in its enforcement?

PURPOSE OF THE AUDUBON SOCIETY.

To secure the protection of our birds by awakening a better sentiment, the Audubon Society, named after the greatest of American ornithologists, has been founded. The object sought to be accomplished by the Society are to prevent, as far as possible,—

(1.) The killing of any wild birds not used for food.

(2.) The taking or destroying of the eggs or nests of any wild birds.

(3.) The wearing of the feathers of wild birds. Ostrich feathers, whether from wild or tame birds, and those of domestic fowls are specially exempted.

How does the Audubon Society work? It says, "The remedy is to be found in a healthy public sentiment on the subject."

And when it uses the word sentiment, it does not mean a namby pamby idea, a dudish feeling, a sickly, foolish, æsthetic idea which scorns the useful, and glories in a sunflower badge.

Sentiment is a combination of science and heart; science points out the path, and the heart impels the individual to action.

Hence when our friend, Dr. Langdon, heads his remarks, Science versus Sentiment, he either gives a very low meaning to the word "sentiment," or puts science in a false position.

The idea of the Audubon Society is to create a principle of action founded upon intelligent public information and knowledge.

Obviously it could not afford to use clap trap arguments, or to distort the facts, as such a position would in the end destroy confidence in its movements and react with terrific force in its overthrow.

It is not to be supposed, therefore, that it would intentionally throw itself upon the public of 50,000,000 of people without at least believing that it had a deserving and necessary cause for action.

Moreover the source from which a movement springs assists us materially in determining whether the movement is founded upon right reason.

Who are the originators of this movement? They are powerful thinkers, men who have devoted their lives, some of them well advanced in age, to the study of birds, their habits, their haunts, their food, the causes of their destruction, and to their presence or absence in different localities.

The American Ornithological Union comprises a large number of the best ornithologists of the United States, and their committee fully and heartily endorses this movement.

So far as the foundation of the Society is concerned, therefore, we have a *prima facie* right to suppose that there is a good and sufficient cause for its beginning.

Dr. Langdon attempts to palliate the acts of the small bad boys in killing birds and robbing birds' nests of their eggs, and he even goes so far as to instance the youths of Professors Baird and Audubon as an excuse for the acts of these small bad boys.

If the small boys were as good as Audubon they would never have been mentioned by me. In my former remarks I stated that a lady from St. Louis mentioned that during last month, a boy about 10 years old living in an adjacent house in the suburbs of St. Louis, and who had a gun, was accustomed to get up early in the morning and shoot at every bird he could see.

I also instanced that on Price Hill this season, a boy was seen to shoot at various birds and kill them, and in one instance shot a bird by its nest of eggs, that the man who accompanied the boy apologized by saying that the boy was learning to shoot.

I also mentioned a boy near where I live who had a stone slinger and out of school hours had devoted parts of his time to using his stone slinger. He hit ten birds, eight of which fell to the ground wounded.

Up to the time of our last meeting, his playmates say he had killed about fifty birds. Since then he had been at work, and has been known to break a bird's leg tie a string around the leg and let the bird go. Only a few days ago, he shot a sparrow in the eye, and not only put out the eye, but he must have injured the bird's brain, as the poor little thing could no longer fly and hopped about with its eye out, and a crowd of little boys about it, who picked it up and examined its wound.

Now such indiscriminate killing can not be justified in any way. It cannot be just to the subject or to Audubon to cite him, a lover of birds, in such connection. As well might we justify boys who stone frogs, or throw stones at horses, on the ground that some

naturalist might be found among the attacking crowd who might subsequently enjoy studying the anatomy and skeleton of a horse.

If the Doctor pleads for the bad boy, that very often he is thoughtless and does not realize the mischief he is doing, I will join hands with him over that, as I think a great deal of boys and believe much of their mischief is due to thoughtlessness and a lack of knowledge of the nature of the evil they are doing. And the Audubon Society is of the same opinion. But the Doctor wants the subject of the bad boy dropped right here. Here is where we take the subject up.

We believe the public has a duty to perform towards these bad boys and that duty consists in explaining to them the nature of the evil they are doing and by remonstrance and presuasion to get them to desist from this evil habit. One object of the Audubon Society is to inform the public as to the manner in which our birds are destroyed, and to persuade each member and the public to use their influence to protect the birds.

And now let us approach a very important branch of the subject. Dr. Langdon quotes the following figures together with his criticisms as follows:

"Mr. William Dutcher states (quoted also by your committee,) 'that 40,000 terns were killed on Cape Cod in one season; that at Cobb's Island off the the Virginia Coast, 40,000 birds,' mainly gulls and terns, were contracted for by an enterprising woman from New York, to ship to Paris; that 11,018 skins were taken on the South Carolina coast in a three month's trip of one dealer; that seventy thousand were supplied to New York dealers from a village on Long Island.

Note, if you please, that these large figures apply to '*coast*' birds, mainly or entirely, therefore composed of gulls, terns, and the 'shore' birds."

Dr. Langdon further says; "My friend, Mr. Geo. B. Sennett, is also quoted in this article as stating that he overheard the agent of a millinery firm endeavoring to make a contract in Texas for ten thousand plumes of egrets (a species of heron, or fish-eating wader.)"

Now the Doctor knows that shore birds include numbers of our waders and that these birds are not limited to the ocean coasts, but in their spring migration pass upward through the United States, and many breed in the United States, while others pass northward

to breed. They live along the Great Lakes, in the damp grounds and marshes of our land, and winter along the southern coasts, and in the marshes and humid ground of the Southern States. Now, as to the gulls, let me say, that I for one delight to see them in life as they fly hither and thither over the ocean, here poised in flight, there skimming the surface of the emerald waves, now plunging for a moment into the ocean, again battling with the rising tempest. I say I have infinitely more pleasure in seeing them thus than to see their wings or heads, or tails upon a woman's bonnet.

We are not, I submit, mere animals to eat and drink and nothing more. Whatever contributes to our mental and higher nature and to our spiritual enjoyment, is of high utility and value. Now I hold that there is more real elevation and enjoyment afforded by a sight of the gull at home as he in varied flignt moves over the ocean than when his head or tail is located on a lady's hat.

And I maintain this position is true of birds in general, even though none of them were endowed with song, and none of them were useful as scavengers or as destroyers of insects. Their living presence is better than their lifeless skins. Audubon expressed the opinion of all true lovers of nature when he said, "the moment a bird was dead, however beautiful it had been in life, the pleasures arising from its possession became blunted."

Another use of the gulls is stated in "Science" and is this. Their destruction and consequent absence from the coast waters the bluefish fishermen say, is: "A serious evil to them, as formerly when they saw these hovering flocks, they knew that the bluefish were there and could easily be secured." And as to the shore birds I have more to say. They are when living useful to man.

The gulls, terns, and shore birds are termed by Dr. Langdon, "the scavengers of the ocean, and ornithological tramps; * * * whose only 'song' is a 'mere screech or squawk' * * * and which are not in any degree beneficial to man except for their feathers." This last statement, I call in question. I have already shown some of the ways in which the gulls exhibit their usefulness to man, and a few quotations from Nuttall will indicate the value of the cranes and herons. As to the Whooping Crane, Nuttall says, "They swallow also mice, moles, rats, and frogs with great avidity, and may therefore be looked upon at least, as very useful scavengers. They are also, at times, killed as game, their flesh

being well flavored, as they do not subsist so much on fish as many other birds of this family."

Of the Great Heron, Nuttall says, "On land our Heron has also his fare, as he is no less a successful angler than a mouser, and renders an important service to the farmer in the destruction he makes among most of the reptiles and meadow shrews."

These habits are generally those of all the members of this great family.

The Doctor says as to the water birds they are doomed to extirpation whenever civilization drains and cultivates their nesting and feeding places. I would like to ask when that time will be? When will all the wet and humid ground in our country be all drained and cultivated? We may expect a good deal of humid ground and the presence of water courses and marshy shores, and lakes so long as rain falls.

But this is not near the full extent of our argument. The fashion of wearing birds' heads, wings, and tails has become more and more fixed. The heads of the shore birds and the gulls, and terns are undesirable for hats. The length of the bill is an objection and many of the birds and their heads are too large.

Let us pause a moment to consider the condition of society and the feather business at the time these 110,000 American birds have been killed. With these birds there have been worn others from foreign countries, humming birds, parrots, macaws, doves, and plenty of other species.

We have in existence certain enginery for the destruction of birds. We have a habit created of wearing dead birds. People with money to buy what fashion demands, and without a thought as to the unfitness of the article for dress, and careless as to the destruction of bird life caused by this fashion.

We have immense feather millinery establishments, located for the most part at New York City, establishments striving to sustain their trade; and we have the boys and men employed to shoot the birds. Out of the $1,000,000.00 made last year on the sale of American bird skins and feathers, about 40 per cent. went to the gunners and trappers, that is, $400,000.00 were paid to boys and men to collect American birds and feathers.

If the supply of water birds decreases, is it not the most natural thing in the world for this army of shooters to turn upon

the insectivorous birds and collect them? Everything favors it. A debased public sentiment, making a demand for birds' heads and the like, a reality, and more than that, a vast pecuniary inducement, a set of feather milliners who propose to serve the public demand, and an army of shooters whose living is made out of the business.

We can rest assured that unless the pernicious habit of wearing birds' heads is checked by a healthy public sentiment, the next few years will see the shore birds and the water birds largely destroyed and great inroads made upon our song and insectivorous birds. And the people will awake some morning to find our song-birds gone.

I quote again:

"One New York taxidermist had 30,000 skins of crows, crow-blackbirds, red-winged blackbirds, and snow buntings."

Ah! here we have it, drifting from the killing of water birds into the killing of land birds. Even the Doctor admits that the red-winged blackbird has a desirable song—a clear whistle, and admits that the snow bunting is an insectivorous bird. Yes, drifting into killing our insectivorous birds and song birds. An ounce of prevention is worth a pound of cure. If when thus warned we do not look ahead and prevent the evil, we deserve to lose our birds.

Thus far we have taken figures which the Doctor admits to be correct, and have argued upon these. Now we propose to dispute certain of his figures and a good many of his propositions.

First, he says, "We may estimate that the 15,000,000 square miles comprised in North and South America and the West India Islands will average at least 200 birds to the square mile," and again he says, "According to this estimate then we would have a bird population in the Americas of 3,000,000,000." In answer to this, I may say that I think that 200 birds to the square mile is much too large an estimate. Many of the species of birds which winter in the Southern States are in the Northern States in the summer. In the northern part of the United States but few birds are found in winter.

In the next place, in parts of North America but few birds are present. For example, in the vast, high and widely extended slopes of the Rocky Mountains, where the flora is scarce, so, also,

is the fauna. On the great alkali plains of the West, there are practically no birds.

In the Adirondacks, a region 60 miles square, occupying a large part of the northern half of the State of New York, bird life is scarce. In reference to this region, Prof. C. Hart Merriam, in his preliminary list of birds ascertained to occur in the Adirondacks region, north-eastern New York, says: "One point in the present list requires explanation. The terms, 'common,' 'abundant,' etc., do not have the same signification as in a treatise on the birds of Southern New England for example. Birds of all kinds are rare in the dense evergreen forests of the Canadian Fauna. One may travel hours, and sometimes a whole day, among these lonely mountains and scarcely see a single bird." (See Nuttall Ornithological Club, Oct. "81," Vol. 6, No. 4). This statement is confirmed by my own observation in these forests. In view of these facts, I hold that the bird population is no greater than 2,000,000,000.

Furthermore, it must be remembered that but comparatively few birds of South America visit the United States and but comparatively few of the birds of the United States visit South America. So when our insectivorous and song and water birds are decimated and destroyed, what are we going to do about it? Why the feather milliners will send to South America for bird skins and feathers. Will that give us our birds back? And if by dint of laws and rigid protection some species of our song and insectivorous birds again multiplied and replenished this land, this much desired event would not be likely to occur in our day.

The Doctor says: "Prominent amongst the statements made in Mr. J. A. Allen's paper and quoted by your committee in the use of birds for millinery purposes, is the assertion that 10,000,000 American women are of a 'bird-wearing age and proclivities.' Some might consider this an exaggeration, which it probably is, but for the sake of a basis we will admit it to be true. Mr. Allen further estimates, allowing for the making over necessities of the economically disposed ladies, that 5,000,000 birds per year will be required to satisfy this demand."

Now I hold that 10,000,000 women of bird and feather wearing proclivities will use nearer 15,000,000 birds annually than 5,000,000. I hold that the estimate that 5,000,000 of birds represents approximately the number destroyed is far too low an estimate; and Prof. Allen himself thinks so too, as I shall presently

show. A woman very often wears two or more birds on her hat or dress, and often wears more than two wings. In fact it is quite customary to do so. I have often seen the heads of two birds on the same hat.

In my former remarks I quoted from the testimony of the Evening Post of April 7, where the writer says: "My visit to the National Academy was spoiled yesterday. Not by viewing bad pictures, either. It was by a young lady's hat. There was nothing in her face to denote excessive cruelty. Indeed, she was very pretty, and the attention she paid to the best pictures seemed to indicate that her artistic taste was not uncultivated. But her hat! The front rim of this was decorated with the heads of over twenty little birds. I counted them at a risk of seeming to stare rudely. These heads were simply sewed on side by side a closely as possible."

A lady of my acquaintance communicates the following:

"Last March a gentlemen residing on the Hudson River requested a lady who had access to the fashionable ladies of New York City to put in a plea for the birds. In a large gathering she made this statement that a lady present had said that she and her daughter had in use on their winter costumes, 44 birds."

An article in one of our local newspapers last month under the head "Boston Correspondence," mentioned that one lady wore blackbirds in the festoons of her dress.

Mr. F. M. Chapman sent to the Forest and Stream the following list of native birds seen on hats worn by ladies in the streets of New York. "It is chiefly the result of two late afternoon walks through the uptown shopping districts, and while very incomplete, still gives an idea of the species destroyed and the relative numbers of each:

"Robin, 4; brown thrush, 1; bluebird, 3; blackburnian warbler, 1; blackpoll warbler, 3; Wilson's black-capped fly-catcher, 3; scarlet tangler, 3; white-bellied swallow, 1; bohemian waxwing, 1; wax-wing, 23; great northern shrike, 1; pine grosbeak, 1; snow bunting, 15; tree sparrow, 2; white-throated sparrow, 1; bobolink, 1; meadow lark, 2; Baltimore oriole, 9; purple grackle, 5; bluejay, 5; swallow-tailed fly-catcher, 1; kingbird, 1; kingfisher, 1; pileated woodpecker, 1; red headed woodpecker, 2; gold-winged woodpecker, 21; Acadian owl, 1; Carolina dove, 1; pinnated grouse, 1; ruffled grouse, 2; quail, 16; helmet quail, 2; sanderling, 5; big yellow-legs, 1; green heron, 1; Virginia rail, 1; laughing gull, 1; common tern, 21; black tern, 1; grebe, 7.

"It is evident, that in proportion to the number of hats seen, the list of birds given is very small; but in most cases mutilation rendered identification impossible.

"Thus while one afternoon 700 hats were counted, and on them but 20 birds recognized, 542 were decorated (?) with feathers of some kind. Of the 158 remaining, 72 were worn by young or middle-aged ladies, and 86 by ladies in mourning or elderly ladies; or, percentage of hats with feathers, 77 3-7; without feathers, 10 2-7; without feathers, worn by ladies in mourning or elderly ladies, 12 2-7."

Now, of these birds seen by Mr. F. M. Chapman, Dr. Langdon is forced to make the following admission, I quote:

"The aggregate number of individuals belonging to this lot is stated at 174, which may be classified as follows: Song birds and useful species, 30; useful but not song birds, 38; birds of doubtful and negative value, 106." So that the Doctor admits that 68 of these 174 birds were undeniable useful species, that is to say, 33 per cent of these birds were well known to be useful to the farmer, the agriculturist, the horticulturist, or to the forester, and 15 per cent to be song birds. Furthermore the Doctor does not deny that the species observed by Mr. Chapman were our own North American birds, with most of which we all are familiar.

An examination such as that of Chapman is like that of a merchant sampling. He selects at hap-hazard here and there and he thus tests the whole lot. The examination is a very satisfactory one and a *very alarming* one. It shows that the use of birds is not confined to coast birds, but that already ⅓ of the birds worn by our women are birds of our farms and are insectivorous birds, and many of them are song birds.

In "Science" we find, "One gunner informed me that during the winter of 1883 he shot for a middle-man over a thousand cedar birds (*Ampelis cedrorum.*) If they had been permitted to live until next season of reproduction, it is fair to assume that each pair would have reared an average of five young, or an aggregate of twenty-five hundred birds. It is a well known fact that cedar birds are very voracious eaters, and feed almost exclusively, during some months of the year, on the span-worm, canker-worm and small caterpillars. The damage done the agricultural interests of the country by the destruction of these birds is enormous."

Let us make a new computation of the rate of mortality among birds from unnecessary causes. We take as our basis of the bird

population of the Americas, 2,000 millions instead of 3,000 millions adopted by Dr. Langdon. And the number destroyed for millinery purposes, 15,000,000 per annum. This alone gives a mortality rate of $7\frac{1}{2}$ per thousand.

The small bad boys of the country are certainly as numerous as the fashionable ladies, and are not less fatal to bird life. What with their pea-shooters, rubber-guns, and slings, and their nest robbing propensities, it is certainly fair to assume that they produce a mortality of 10,000,000 per year. This would raise the mortality rate from $7\frac{1}{2}$ to $12\frac{1}{2}$ per thousand. Then sportsmen certainly kill enough birds to raise this figure to 13 or 14 per thousand.

It has been asserted by Dr. Langdon that a mortality of 20 to 25 per thousand in the human race excites no comment, and the question is asked why should a mortality of $3\frac{1}{8}$ per thousand among birds cause such a furore. Let us examine into this a little further. We have seen that the mortality among birds due to the causes which we are fighting is probably not less than 13 per thousand instead of $3\frac{1}{8}$. Moreover this is a mortality in excess of the natural or unavoidable mortality among the birds. So that the question instead of being as propounded becomes this, if a human mortality of 13 over and above the average mortality commands attention, why should it not when occuring in the bird tribe? Now does such an increase in human mortality command attention? This question has been answered for me by Dr. W. S. Christopher by a comparison with a few figures from the Health office of this city. The average mortality in Cincinnati during the ten years included between 1875 and 1884 was $19\frac{78}{100}$ per thousand. During the year 1882, the mortality was $24\frac{52}{100}$ per thousand, or $4\frac{74}{100}$ above the average, but a little more than one-third of the useless mortality among birds, and we all remember whether the small-pox epidemic of that year was startling or not. Would an epidemic three times as severe be sufficient to call the attention of citizens to the death rate? I think it would. I am also informed that such an increase in the death rate is only the result of epidemic influence; now we must remember that such an epidemic, if I may use the expression, is now afflicting the birds, or has been afflicting them for a number of years and instead of decreasing, it bids fair to increase and to continue. With such a case I ask you, are we not right in asking protection for the birds?

"Science" gives the following inventory, furnished by an ornithological friend, of what recently met his eye in a Madison Avenue horse car in New York City. "The car contained thirteen women, of whom eleven wore birds, as follows: (1) heads and wings of three European starlings; (2) an entire bird (species unknown,) foreign origin; (3) seven warblers, representing four species; (4) a large tern; (5) the heads and wings of three shore-larks; (6) the wings of seven shore-larks, and grass finches; (7) one-half of a gallinule; (8) a small tern; (9) a turtle-dove; (10) a vireo and a yellow-breasted chat; (11) ostrich plumes. That this exhibition was by no means exceptional as to number or variety is obvious to any one who has given close attention to the ornithological displays one daily meets within street cars and elsewhere, wherever he may travel."

This examination also corroborates two points of importance:

First, that out of the eleven women wearing birds, five women wore more than one bird apiece, and these five women wore 21 birds, so that 27 birds were worn among the eleven women, making more than two apiece.

Secondly, out of the 27 birds worn, 18 were useful species and eight of these were song birds. In this instance $66\frac{2}{3}$ per cent of the birds worn were useful species.

Now it will be observed that these examinations were made of birds as actually worn on ladies' hats, and had nothing to do with a simple examination (within a month) of a few boxes of bird skins in a milliner's shop taken at random from a stock of boxes of bird skins such as Dr. Langdon observed. Very likely, at this season of the year, most of the native birds were sold out. The Doctor found at that examination a great many useful insectivorous species, and he found not only that some of these were North American birds, but he found that out of the 137 birds he examined only 20 were coast or water birds. How does this tally with the first half of his argument? The fact is that it goes to show that the terns and gulls and shore birds form only a small part of the birds killed and that the inland birds, the insectivorous, the useful birds, are killed for the millinery trade and worn on hats in enormous quantities.

Last year, before this subject was up, I stopped in front of a millinery store in this city, and among the birds there exposed on hats for sale, I noticed a snowbunting and a woodpecker dyed red. Now both of these birds are useful, even if it be admitted as my

friend Forbes remarks, that the woodpecker is a great bore. The dyeing of birds is a very common practice and the plainer birds can be fixed for market by dyeing them. Consequently when the Doctor says—I quote "That our most desirable song birds, such as thrushes, wrens, greenlets, and finches, are in limited demand on account of their plain colors," his assumption that their generally plain colors will exempt them from being used for trade is unfounded, first because the birds can be dyed, and second, because they are now used without dye, as is shown by the examinations before given in one of which one woman wore 7 song birds (representing 4 species) and another the heads and wings of 3 shore-larks, and another the wings of 7 shore-larks and grass finches.

Since our last meeting, Prof. J. A. Allen one of our most careful and observant and accurate ornithologists, and now Curator of the Department of Mammalogy and Ornithology of the American Museum of Natural History, Central Park, New York City, has written me the following:

"NEW YORK, June 8, 1886."

"MR. W. H. FISHER,
Cincinnati, Ohio.

DEAR SIR:

Your letter and the newspaper clipping in relation to Dr. Langdon's performance were a great surprise to me. I am just now too much pressed by imperative duties to write at great length on this subject. The Doctor, however, is entirely wrong in his assumptions. The figures given in 'Science' are not exaggerations; neither do these statistics relate to terns and herons merely. Our song-birds are sacrificed for millinery purposes by the million annually, and form a very large proportion of the birds lately worn on hats. As an index of what goes on in this line, please note Chapman's article on 'Birds and Bonnets' in Forest and Stream of Feb. 25; 1886, and republished on the last page of our Bulletin. Also, the statistics given of birds on hats seen in a New York Horse-car. These are actual facts, and show plainly enough whether our native song-birds are used to any extent for hat decoration. These are examples merely of what might have been seen at any time in this city, up to a recent date. Taking the native passeres and woodpeckers together, they more than twice outnumber the birds of all other kinds worn on hats, including even all those of foreign origin. Of this there is no question. They are

species, too, that are the most common, well known and useful of our native birds. It was not at all uncommon to see here in New York last winter from *three* to a *dozen* small birds, such as Warblers, Kinglets, Sparrows, Bluebirds, etc., on a single hat, either entire or represented by heads and wings. A dozen kinglets have been reported to me as seen on a single hat. And day after day in riding in cars here I noted six and eight birds to a hat, or at least the wings of that number, and sometimes heads and wings representing a dozen song-birds. The statistics we give in 'Science' go but a short way to adequately set forth what we know to be the real state of the case in regard to the destruction of song-birds. In haste,

Sincerely Yours, J. A. ALLEN."

The position taken that, upon the assumption of certain large numbers of birds still present in our country, no danger exists that many of the valuable and useful species will become practically extinct, can not be maintained in the face of the facts found in New Jersey. In that State the wholesale destruction of bird life was carried on until, as Hon. John W. Griggs, President of the New Jersey Senate, says:

"The complaint came up from all parts of the State, of the decrease in the number of song and shore birds. Representation was made to me that certain persons had contracts to furnish birds by the thousands to taxidermists in Philadelphia and New York, and that they propose to gather their skins in New Jersey. The bill introduced into our legislature for the protection of the birds, passed with only one negative vote, and the effect in my own locality (Patterson) has been excellent."

This corroborates the position that the machinery for collecting bird-millinery having to a great extent exhausted the stock of coast birds would next gather in our other birds.

As bearing directly upon the main features of this discussion, I here take the liberty of reading to you a letter from Prof. C. Hart Merriam, M. D., in charge of the Division of Economic Ornithology, of the United States Department of Agriculture, viz.:

"U. S. DEPARTMENT OF AGRICULTURE.
WASHINGTON, D. C., June 11, 1886."

"WM. HUBBELL FISHER, Esq.,
Cincinnati, Ohio.

DEAR SIR:

I am much surprised to learn from your letter and enclosed clipping of the 8th inst., that so good a man as Dr. Lang-

don has attacked so good a cause as that of the Audubon Society.

"Dr. Langdon's statement that native American birds are almost entirely absent in millinery establishments is not borne out by the observations of myself and others in the Eastern States where nearly half the birds worn on hats are our own song and insectivorous species. His assertion that ten million bird wearing women will not cause the annual slaughter of more than five million birds is absurd, for most women who wear feathers at all (and I rejoice to observe that their number is growing smaller every day) wear those from several different birds at the same time, and I have repeatedly seen the heads or wings of five or six birds on a single hat, and in one instance I counted eleven!

* * * * * * * *

"Judging from the very brief abstract seen of Dr. Langdon's address, it seems to me that in his argument he has lost sight of the most important factors affecting the balance of bird life—a factor which undermines his statistics and vitiates his conclusions,—namely, the causes *other than the willful acts of man* which check the increase of birds. These causes are so numerous and so disastrous to bird life that their combined action renders the struggle for existence peculiarly severe, and owing to the inevitable results of what we are pleased to call the 'advance of civilization,' this struggle will become harder each year. Hence it is certain that, if not soon checked, the willful destruction of birds by man for commercial purposes, superadded to the above unavoidable causes of decrease, will result in the total extermination of many species and in the reduction to the extreme rarity of many others. In a number of cases this result has been already partially accomplished.

"In the animal kingdom, and in fact throughout organic nature, it is the rule that every species has its natural enemies which serve to check its excessive multiplication. By this means a sort of balance is maintained in the scale of nature. But when man steps in to add his potent influence in the destruction of a species the equilibrium is broken and the fate of the species seems to be merely a matter of time.

"The chief causes, other than the willful acts of man, which tend to check the increase of birds, are :

1. *Animal enemies* (mammals, birds, reptiles, batrachians and fishes which prey upon the eggs, young, or adults);

2. *Meteorological agents* (severe storms, particularly during migration and in the breeding season); and

3. *Human agents* which are unintentional and largely unavoidable (such as light-houses and electric light towers, furnace stacks, bridges and other structures, telegraph wires, the destruction of forests, forest fires, prairie fires, mowing of grass during the nesting season, the destruction of breeding sites, etc.)

"You will find a suggestive article by H. W. Henshaw, 'On some of the causes affecting the decrease of birds' in the Bulletin of the Nuttall Ornithological Club, for October, 1881, (vol. VI, No. 4, pp. 189-197).

"Trusting that you will succeed in breaking down Dr. Langdon's argument, I remain,

Very Respectfully,

C. HART MERRIAM, Ornithologist."

In Scotland a society has been recently formed for the preservation of the native birds.

The Queen of England has pronounced against the wearing of birds.

The Audubon Society has much opposition to overcome in the form of organized selfishness. It is accomplishing much

Let the good work go on.

WM. HUBBELL FISHER.

SEVENTH PAPER.

By PROF. JOS. F. JAMES.

(Read June 16, 1886.)

(Abstract.)

The text of the paper was the assertion by Dr. Langdon, that there was little or no danger of any notable decrease in the number of birds in the world, by man's action through any cause at present within our knowledge. The writer showed that in the extermination of the Great Auk, and the wild pigeon, as well as in the notable decrease in numbers of various other species, that man's influence had been all powerful. Quotations were made from various authorities showing how thousands of the Great Auk had been slaughtered by sailors for food, until none are left. The accounts of Audubon and Wilson of the immense flocks of wild pigeons which once frequented the Mississippi Valley were read to show man's potent influence here. For not only were the birds them-

selves destroyed, but the eggs and nests also, by thousands. and in the most wanton and reckless manner. The testimony of Audubon as to the manner in which the eggers of Labrador had desolated the islands off that coast was also given and the opinion quoted that unless some stop was put to the destruction the total extinction of the birds would result.

The writer then went on to show how baneful had been man's action in decreasing the number of fur seals and sea lions in the Alaskan Islands and the South Shetlands. In these places where the animals had once existed in immense numbers, such has been the destruction, that in the latter islands they are nearly extinct and in the former are only preserved from the same fate by laws passed for their protection. This portion of the paper was acknowledged to be somewhat foreign to the subject in hand, but was useful in showing that the power of man was great when exerted in the direction of the destruction of life. Reference was further made, on the authority of Prof. James Orton, to the immense destruction of turtles, by reason of their being sought by man, in the valley of the Amazon.

EIGHTH PAPER.

Dr. F. W. Langdon's Remarks.

(At the Meeting, June 16, 1886.)

In the discussion which followed the reading of the second series of reports of the committee, Dr. Langdon said:

Mr. President—It is evident from what we have just heard that my statement at our last meeting, that "this is a large subject," was a very true one.

It is not my intention to weary you at this late hour with any extended remarks.

Before opening the discussion, however, I hope it will not be considered out of order for me to return thanks to the Society of Natural History for the compliment implied by the calling of a special meeting to consider my remarks. I did not presume then to be of so much importance. I should also not omit to thank the essayists of the evening for the very valuable array of original ornithological facts and thoughts presented, which are quite an improvement upon their former report.

The statement of one member of your committee that my

previous remarks will have a "pernicious" effect I can not believe, as they have certainly had, so far, the very *good* effect of influencing the committee, as well as other members of the society, to *think for themselves* upon the subject, and not simply take for granted the misapplication of statistics by writers in popular journals and elsewhere.

This is not a mutual admiration society, but a society for the discussion of scientific topics, and no subject can be said to be fairly discussed of which one side only is presented.

I would ask your attention therefore for a few moments to some of the main points in the committee's papers so far as they apply to the question at issue, *i. e.* the probable extinction or notable decrease in number of our native song birds by reason of their use for millinery purposes. Dismissing then all reference to the extinction, by man and other causes, of the wingless or non-flying (and non-singing) birds, such as the Dodo, the Great Auk, &c., and of the mastodon, mammoth, and so on, as entirely foreign to the subject, and waiving the discussion of the market price of mud turtles and other commissary supplies—what then have we left in this second series of papers by your committee?

Chiefly citations of reduction in numbers of birds used as food, such as the wild pigeon, prairie chicken, wild turkey, and so on; species whose destruction is inevitable in any civilized country; which are *not* song birds, and which were exterminated just as rapidly before the days of bird millinery in this country. Moreover, as stress has been laid upon the *economic* influence of this destruction, it is pertinent here to cite the fact that man *replaces* these species with *tame* pigeons, chickens, turkeys, and so on, of more value, economically considered, than the wild ones.

The statement of your committee that "all birds are useful" is no more true than that all plants are useful—that is, useful to man; that all have their use in the economy of nature is indisputable, but we do not for that reason intentionally sow our fields in weeds, and there are "ornithological weeds" as well as botanical. In support of his proposition I have already cited the fact that many species of birds make their "use" felt by man by destroying the very song birds he wishes to preserve, and in evidence I would refer to the various standard works which treat of the life histories of the jays, shrikes, some hawks and owls, crows and other predaceous species. To the query of one member of your committee, "What birds are not useful?" I would further cite the fact that

even the proposed "Audubon Societies" do not advocate the protection of the European sparrow; they do not even give him credit for what good he undoubtedly does do.

The pleasant sarcasm of my ornithological friends I enjoy as fully as any of you; but sarcasm is not argument. To the various misquotations and misinterpretations of my former remarks I have no reply to make, since they carry their own refutation upon their face; and I should be very sorry to believe them malicious in their intent.

While one member of your committee considers as excessive my estimate of three billion as the total bird population of the Americas, another member cites as credible Wilson's computation of wild pigeons in a single flight at over two billion; and a third member corrects me by placing the entire bird population of the Americas at two billion only. Until the committee can reconcile their own differences in this respect I shall think it useless to attempt to do so for them. As for my estimate being a "mere guess," the same argument applies to their own. I would state, however, that I consider my estimate a very moderate one, based on personal observation over a wide extent of country at various seasons, and quite as fully entitled to credence as the estimate of ten million bird-wearing women in the United States, advanced by Mr. Allen, and offered as evidence by your committee.

Again, while the marine species and water birds generally (non-singers) are cited by tens and hundreds of thousands, the fact remains that the birds especially under consideration (North American song birds) are mentioned by dozens and rarely by hundreds, in connection with their use for millinery purposes. The ten thousand Nonpareil Finches mentioned by your committee as traped in Louisiana and Texas for *cage* purposes have nothing to do with the millinery question, nor do they effect the fauna of the Eastern localities where the alleged decrease of small birds is taking place. Moreover, in these older Eastern States, where collectors and ornithologists have been observing birds closely for fifty years or more, no notable decrease in the familiar song birds has been recorded by this reliable class of observers. As for the statement of a member of the *New Jersey State Legislature*, which applies only to the immediate vicinity of one city, it comes from no recognized ornithological source; and I would further submit to your careful consideratlon that the average legislator is more competent to estimate the *votes* than the *birds* in his precinct.

That several gentlemen have "*cried wolf when there was no wolf*," the following recent advertisement is, in my opinion, good evidence, as showing the lack of the figures and facts called for:

"Information wanted upon the needless destruction of birds, with facts and figures, by the Committee on Protection of Birds, of the American Ornithologists' Union. Address,

"Care of AMERICAN MUSEUM NATURAL HISTORY,

"New York."

In my remarks respecting the junior ornithologists or "collectors" of this country, I made no attempt to justify wanton cruelty by small boys or others; nor do I believe that "total depravity" is a universal characteristic of our boys. I have a better opinion of human nature. Such cases of cruelty as cited by your committee should be discussed by their parents, with a stick if necessary, but better by the instillation of correct moral principles. This, however, is beyond the province of this or the Audubon Society.

I would call your attention to the fact that nowhere have I advocated or justified the useless killing of our native song-birds. I have simply given it as my opinion, based upon the evidence, that such destruction, while deplorable in its sentimental aspects, occurs to such a slight extent as to make it practically inappreciable in its effects upon the fauna of the country. Neither in the figures quoted by your committee or elsewhere is this view controverted. I have not opposed the formation of "Audubon Societies" as such, for the protection of birds, I have simply criticised their extravagant and unsustained claims to economic importance, and would here direct attention to the fact that the "Audubon Societies" are simply the outcome of an advertising scheme on the part of an Eastern journal devoted to the interests of a class of people who are habitual destroyers of birds for *mere sport*.

The ornithologists of the country, both amateur and professional, are, as a rule, gentlemen, and as such their statements of *facts* are worthy of the utmost credence, which I freely accord to them. I censure no man, moreover, for his views, while claiming the privilege to criticise opinions when based on false premises.

Your committee has neither disproved my statement that statistics of destruction of gulls, terns, herons, grebes and shore birds have been misapplied so as to apparently affect song-birds; nor has it brought forward any additional facts of consequence regarding

the latter class and their use for millinery purposes. My other statement that there is no record of any of our familiar song-birds having become rare or extinct over any wide extent of our country remains unshaken; nor does your committee give the various actual causes for decrease in limited localities proper recognition.

In short, the report of your second committee is a reply that does not answer, a statement that does not refute. So far as the main points at issue are concerned, therefore, and resting *upon the evidence*, I submit to your judgment (*not your sympathy*) that the efforts of your second committee have been a failure in their avowed object of disproving my conclusions; and that the reports of your committee respecting the extinction or notable decrease of North American song-birds for millinery purposes, still contain, I am glad to say, more poetry than truth.

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THE JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Publishing Committee:

GEO. W. HARPER. WM. HUBBELL FISHER.
TRUMAN H. ALDRICH. THOS. FRENCH, Jr.
DAVIS L. JAMES.

JANUARY, 1887.

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OFFICERS OF THE SOCIETY—1886-7.

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The Publishing Committee is under obligations to Robert Clarke, Esq., of Cincinnati, Erasmus Gest, Esq., of New York, and Dr. L. B. Welch, of Wilmington, O., for the use of the electrotype plates used to illustrate the article by Mr. J. R. Skinner, in this number. The engravings furnished by the two former gentlemen are now for the first time printed.

THE JOURNAL

OF THE

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VOL. IX. CINCINNATI, JANUARY, 1886. No. 4.

PROCEEDINGS.

BUSINESS MEETING, *Tuesday, October* 4.

President Dun in the chair, present sixteen members.

Miss Clara B. Fletcher, Miss Amanda Frank, Miss Laura J. Frank, Mr. Herbert Jenny, and Dr. M. H. Fletcher were proposed for membership.

Miss Emily Hopkins, Miss Mollie Geoghehan, Mr. Theodore P. Anderson, Mr. Horace P. Smith, and Dr. John D. Jones were elected active members.

The minutes of the Executive Board for April, May, June, and July were read.

Mr. Twitchell read a paper upon "Noctoc pruniforme."

A meeting of the Botanical Section was announced for October 16th.

At the request of the Society, the Chair appointed Dr. Wm. Carson a committee of one to report a notice for publication in the JOURNAL of Mr. John B. Clunet, and Prof. Joseph F. James a notice of Mr. E. S. Comings, both lately deceased members.

The Secretary called attention to specimens of Gentiana crinita and G. Andrewsii, exhibited by Dr. Norton and Mr. Warder.

The President was authorized to sign, for the Society, an invitation to the International Congress of Geologists, to meet in the United States in 1888.

On motion of Prof. George W. Harper, Prof. A. G. Wetherby was invited to read a paper on the Conchology of the Roan Mountain region of Tennessee and North Carolina.

Prof. Harper asked for instructions regarding an exchange of fossils.

Referred to the Librarian and Executive Board.

Donations were announced as follows: From Chief Signal Officer, Monthly Weather Review for July; from Prof. Edward Orton, Columbus, O., Preliminary Report on Petroleum and Inflammable Gas; from T. H. Aldrich, Bulletin No. 1 Geological Survey of Alabama; from H. P. Smith, Climate and Time, James Croll; from Dr. L. Darapsky, Santiago, Chili, Verhandlungen des Deutschen Wissenschaftlichen Vereins zur Santiago; from C. L. Faber, 221 species of shells; from Mrs. J. R. Hunt, Columbus, O., Specimens of Algæ.

Adjourned.

SCIENTIFIC MEETING, *Tuesday, November 2d.*

Vice President Fisher in the chair; twenty members present.

A short paper by Dr. J. H. Hunt, on the Nesting of Martins in Tallahasse, Florida, was read by the Secretary.

Mr. William H. Knight, in presenting a specimen of Dynastes tityus from Mr. G. W. Lewis, of Yosemite, Ky., made some remarks upon the Coleoptera in general.

Prof. G. W. Harper gave an interesting account of the pursuit of a caterpillar by a carnivorous beetle, as observed by a friend.

The Secretary exhibited specimens of Hamemelis Virginica in flower and of Wolffia Brasiliensis. The latter was collected from a pond west of the Big Miami River by Dr. J. H. Hunt and Mr. George Twitchell.

Mr. J. Ralston Skinner said "Mr. James' remarks on the witch hazel, call to my mind that the fork of the witch hazel is popularly taken as the appropriate wood for finding wells of water and the like in the hands of what are called *divines*, or *water-witches*; my accidental experiences go to prove that there is a measure of truth in the claims of ability to *divine*. But investigation has shown that the ability lays in the peculiar nervous organization of the person, and not at all in the kind of wood used. The wood may be of peach or willow or maple, etc., and may be dry or green. The nervous organization must be alive to that of 'Reichenbach's sensitives,' or to that of 'trance mediums,' so called,—bordering on a tendency to epilepsy.

"A friend of mine desired to find a spot for sinking a well. A man who happened to stop at his house to rest and dine, and to

whom he spoke of his desire, owned that he could find a current of underground water for him if there was one. They went to a peach orchard back of the house, where the man with a peach fork, found a stream of water, which was very sinuous in its course. My friend followed him and dropped at every step or two a bit of bark, broken from a piece in his hand, unobserved by the witch. The spot for sinking the well was selected (which by the way proved a success) and they returned to the house. Some hours afterward, my friend asked the diviner if he could follow or retrace the same line. He said he could; and upon trial he did so, my friend proving the fact to his satisfaction, by means of the bits of bark, with which he had *blazed* the sinuous winding of the course on the first trial. The distance must have been about a fifth of a mile.

"As a second instance: Mr. Charles Latimer, of Cleveland, is singularly gifted in the use of the rod. With it he located wells of water of great value to a rail-road company for water stations, and in difficult places. But he found that the rod would serve in his hands for locating coal beds, at a depth of two hundred and fifty feet below the surface, with no external marks. He did locate coal beds successfully near Youngstown, Ohio; and that where the coal deposits are sporadic, being as it were beds of small lakes or peat bogs. A party having faith in his statement, tried for the coal, found it, took the leases of the grounds, paid Mr. Latimer a large sum as consideration and a certain sum per ton output. The output has been some hundreds of thousands of tons.

"Mr. Latimer was employed by a gentleman having such a coal mine, in that vicinity, *to survey its bounds*, and he did this in my presence, I blazing the lines for him, as is done in surveying. While thus engaged Mr. Latimer, in the midst of the deposit, came on a place in which the rod showed "no coal," and tracing it, he worked out quite a large rectangular area. While expressing his surprise, I noticed the owner smile; who (the owner) then asked us to go with him across the fields to the mouth of the shaft. We descended with him down the shaft into the mine, and he then conducted us by one of the rail tracks along a tunnel in the coal. At some distance we came to quite a large square or oblong chamber made by mining out the coal. Here he stopped, and said to Mr. Latimer,—"This is the vacant place below where you found no coal". These are but specimens of facts equally singular happen-

ing in the experience of Mr. Latimer. On one occasion he was requested to locate the large water-main, running through the park in the City of Cleveland. This he did, the location proving correct with the official plats.

"There is quite a large amount of literature on this subject, extreding back some hundreds of years."

Dr. Dun now took the chair. Mr. Fisher in presenting the society with a report of the New York Forestry Commission, the gift of Mr. T. B. Basselin, spoke of the progress of Forestry in the Adironidac region, and gave an account of the chief destroyers of the forests there. These were, the charcoal burners, the pulp makers and fires.

Members were proposed as follows: Dr. John C. McKenzie, A. W. Whelpley, C. M. Cook, Clough Anderson, Dr. J. L. Cilley, Miss. Amelia Miner.

The following persons, proposed at the preceding meeting, were unanimously elected members: Misses Clara B. Fletcher, Amanda Frank, Laura J. Frank, Dr. M. H. Fletcher, and Mr. Herbert Jenney.

A report on an amendment to the By-laws, made by Mr. William H. Fisher to the Executive Board and referred to the Society, was read. The report referred to a more definite understanding of the rights of the society to priorty of publication of papers read before it.

A resolution was presented as follows and laid over for discussion to the next meeting:

"*Resolved*, That the Society have the right to first publication of articles read before it; and

"*Resolved*, That if the Publishing Committee decline the paper it shall be returned to the writer."

Dr. Dun stated that a movement was on foot to give a course of lectures, for the benefit of the Building Fund, in some public hall. A circular asking for subscriptions to the course had been prepared, and would be mailed to members in a few days. The text of the circular was then read.

Mr. W. H. Knight said that Dr. Charles Caldwell had offered to deliver a course of ten free lectures to students and teachers in the rooms of the Society. His offer had been accepted by the Lecture Committee, and the lectures would begin Saturday, November 14th.

Donations were announced as follows: Chief Signal Officer, Monthly Weather Review for August; from D. G. Brinton, Philadelphia, Iconographic Encyclopœdia, Vol. II.; from William H. Knight, specimen of *Dynastis tityus*: from Dr. O. D. Norton, two specimens Euplectella speciosa, Fruit of Myrica cerifera; from Harry DeWar & Co., specimens of Georgia Marble; from Davis L. James, United States Naval Observatory Astronomical and Meteorological Observations for 1868; from William J. Schiff, Red-shouldered Hawk; from Cliff Allen, specimen of Owl; from Zoological Garden, Black Wolf, Wild Cat, Iguana, Moustache Monkey, Bonnet Monkey, Carapace and Plastron, and Carapace and skull of Macrochelys lacertina, Carapace and Plastron of Testeudo carolina, Clarke's Crow, Texas Peccary, Java Sparrow; from Charles Dury, skeleton of White Whale; from David Ivor, Moscow, O., concretions from Blue Limestone Quarries, Pendleton County, Ky.

Adjourned.

Tuesday, December 7.

Mr. William H. Knight, President *pro tem*; twenty members present.

The minutes for the November meeting were approved.

Mr. Horace P. Smith read a paper upon Bison latifrons.

Dr. Dun then took the chair, and papers were read by title by Mr. L. M. Petitdidier, on "Photographic Apparatus and Appliances," and by Mr. T. H. Aldrich, on "Tertiary Fossils, with Descriptions of New Species."

Notes for the Zoological Miscellany of the JOURNAL were also read by title.

Dr. W. A. Dun spoke of the Natural Gas of Ohio, and of the probability of finding gas within a short distance of the city. The line of uplift known as the Cincinnati anti-clinal seems to pass through the gas fields of Northern and Central Ohio, and according to the best belief of geologists, a few miles East of Cincinnati. The suggestion was made that perhaps it would be well to investigate the country east of the city.

Members were elected as follows: Dr. J. C. Mackenzie, A. W. Whelpley, C. M. Cook, Clough Anderson, Miss Amelia Miner.

The resignations of Rev. H. D. Waller and J. W. Innes were received and accepted.

Mr. George F. Card was elected Curator of Chemistry and Physics in place of Prof. Thomas French, Jr., resigned.

A request for the formation of a section for the study of electricity was referred to the Curator of Chemistry and Physics.

The President announced that the Photographic Section contemplates giving an exhibition of lantern slides for the benefit of the Sinking Fund.

Mr. Knight, of the Lecture Committee, said that the course of lectures on Comparative Anatomy by Dr. Caldwell had been begun, and were largely attended by teachers of Cincinnati and Covington.

The President said that the proposed course of lectures for the benefit of the Building Fund had not received the expected favor, and would probably be given up this season. Prof. Cope would, however, lecture twice in the city, probably after the conclusion of the Unity Club Sunday course.

The Lecture Committee, in response to an inquiry, said the usual course in the Society's rooms was being arranged and would be soon announced.

The President also announced the formation at an early day of a class of young people for the study of zoology and botany, under the direction of the Custodian, Mr. Smith.

Donations were announced as follows: From Bureau of Education, Special Report on Educational exhibits at New Orleans Exposition; from William Hubbell Fisher, Report of New York Forest Commission for 1885; from Chief Signal Officer, Weather Review for September; from William Findley, specimens of Granite from Custom-house Building; from S. P. C. A., Ninth Annual Report of American Humane Association; from Alexander Agassiz, Annual Report of Curator of Museum of Comparative Zoology at Harvard College for 1885; from D. G. Brinton, Ikonomatic Writing; from Joseph F. James, Bulletin No. 2 American Ornithological Union; from M. Bofill, Barcelona, Contributions a la Faune Malacologique de la Catalogue; from Hon. John F. Follett, Smithsonian Report for 1883, Report of Bureau of Ethnology 1880-81, Fourth Annual Report of United States Geological Survey; from Miss Magurk, Birds of Kansas, N. S. Goss; from E. D. Cope, Vertebrata of Swift Current Creek Region of Cypress Hills, Phylogeny of the Camelidæ; from Zoological Gardens Golden Pheasant; from Davis L. James, Tufted Titmouse; from Dr. C. E. Caldwell, Lamprey Eel.

Adjourned.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Continued from page 162.

APPENDIX C.

THE "RICHARDSON TABLET" THE "GEST TABLET" AND THE "CLARKE TABLET" AS RELATED TO AND CONNECTED WITH THE "GRIDLEY MEASURING STONE."

Introductory remarks on the significance of the Richardson and Gest tablets.

These tablets are pictures or ideographs. The pictures are phallic and through the phallic idea give rise to an expression of measures of time, as their chief function. These tablets are of very great archæological value, in the opinion of the writer, as affording a solution by their simple plainness of the much vexed question of the pre-historic intendment of the symbol of *the cross.* They afford an interpretation of the so frequent cross symbols of Central America; and by this help, these in turn almost assuredly interpret the more obscured Asiatic representations. No one after examining the Richardson Tablet need go astray in assigning a proper causative idea for the use of the emblem of the cross in prayers for rain in Central America. These tablets lead us to a comprehension in an important degree, quite satisfactory, of the Palenque Cross; and that in related connection with the old Mexican hieroglyphical manuscript cross of the M. de Ferjèrvàry man uscript at Budapesth Hungary, pictured in volumne 22 of the Smithsonian Contributions to Knowledge. In this last the tree of life rises out of the yoni; under another meaning of the same symbolism life rising out of death; and this is part of the significance of the Palenque Cross. Having obtained a clear idea to some extent, of the symbolic interpretation of these, we become reassured as to a like significance attaching to the yoni and lingham symbols of the Hindus, and especially to the *asheras* or *groves*, as depicted by Dr. Inman in his "Ancient Faiths embodied in Ancient Names." Indeed the phallic creative or generative symbol seems radical as to all systems of religion, ancient and modern, pagan and Hebrew and Christian. So far from being hurtful to a rationa

or philosophical view of the latter, this helps to even a more acceptable comprehension thereof. For in place of looking upon the Hebrew system as springing abruptly out from the world of thought, and the nations, as the first true revelation of a personal God to man, we become informed that this Hebrew system was a legitimate development of a world effort at formulating a mode of religious philosophy; out of material long before accumulated by the pre-semite Old Babylonians and Egyptians, who can be traced for their origin in Asia to the head of the Persian Gulf and the mouth of the Nile, where the trace is lost, unless it be recovered in Central America, and thence from the Mound Builders. The old and pure ideas conveyed under symbols, became lost, and acceptance of these symbols was made merely for what the eye saw; consequently a degredation to the sensuous, and that inexpressible offensiveness to modern ideas, which so loath any possible connection or relation of such symbols with the high ideals of the teachings of the Hebrew and Christian sacred books. We may look upon the Hebrew religion as contained in the Sacred Text, as recognizing this ancient symbolic origin as the very source out of which it sprung, and the scaffolding or skeleton on which it was framed. But in doing this it reformed the abuse of gross interpretation and reverted to the true and ancient use of the phallic or nature symbols, as setting forth a mode of exact science, which should lay at the basis of religious worship. Out of natural science or knowledge the development of the true and pure went on evolving out of the ages, culminating in the Christian Dispensation, which to-day actuates the world.

The writer would refer to the very sensible temperate and judicious remarks on phallic pictures made by Mr. Charles Rau in Chap. iv, ("The Group of the Cross.") of his article on the Palenque Tablet, published in volume 22 of the Smithsonian Contributions spoken of; two of which it seems well to quote:

(*a*) "However, it will be evident to every one who has the faculty of divesting himself for a time from now prevailing ideas that the mysteries of generation must have powerfully acted upon the imagination of men in earlier ages, and must have led, in consequence of a tendency characteristic of a certain stage in human development, to the symbolization of that life-giving and life continuing agency. In the course of time the meaning of the emblem

became modified, though it always appears to relate in some sense to the creative energy of nature."

That which proves Mr. Rau to be right is the fact that, among other things, the technical terms for these real images with the Hebrews, became in after times, and are to-day made use of in modern languages, to convey a modified and spiritual, in place of a real, significance.* Again:

(*b*) "The pudency of Christian nations of our time is by no means an innate quality, but simply the result of long-continued training."

This remark also is true. No one can carefully study the reach of phallic symbolization without, somewhat to his amazement, finding that one of the chief places for discovering multitudes of representations derived directly from it is in church ornamentation and dress. It seems the place especially devoted to this mode, slightly, and only slightly, obscured. The writer is led to make this comment from the idea that, though the remark of Mr. Rau is true in itself, Mr. Rau seems to have labored under a common misapprehension in making it, viz., that of attributing to the origin of the symbol, and its use, a gross, sensual, and truly degrading, because merely animal and sexual, conception. The writer considers that the use of the symbol was conceived of in the utmost purity of thought, as the very basis and radix of all the religious systems of worship, and of all theosophic philosophy, which the better world has ever possessed.

He would also call attention to a remarkable fact connected with the phallic literature. While the cross-bones and skull have ever been taken as emblems of mortality, the grave, and decay, they have been also taken as the emblems of femininity and its generative functions. In Hindoo representations, the skull and cross bones are placed over the pudenda, or door of life. The mountain top, gilded with light, presents the same type when con-

NOTE.—For an illustrative instance: The Hebrew Jehovah, in the most solemn passage of Exodus, gives his name as SaCR, which word means, in its first and essential signification, *membrum virile*. From the signification the word, passing over to the secondary meaning of *male*-victim, through the offering of which the Deity was *memorialized*, hence took the derived signification of "*memorial*." "The making of, or placing the SaCR. or *memorial*, before the Lord," was handed down, *idem sonans*, among the nations, and with the Roman priest became "SaCR-*facere*," or afterward, with the English-speaking race, SaCR-*fice*; thus showing that the latest modern usage points back to the ancient phallic usage as its essential element. To this can be added: The word *cherub* is, in Hebrew, a *participle* from the word CRB, the participle being CRUB (*cherub*). For the initial C use its kindred form SC, and we have SCRB, which, with the proper voweling and the Greek termination, gives us SCaRaB-*eus*, the *scarabeus*, or Egyptian beetle, emblem of divinity. The Egyptian hieroglyphical meaning of the *winged* beetle was, especially, *the flight of lunar time*; being sacred to the moon (Seyffarth); because of the moon's supposed generative influence.

trasted with glooms of deep recesses or valleys. While the phallus represented life giving or bearing energy, and the yoni passive receptivity, the contrasting ideas were paralleled with those of life and death The woman represented the door of darkness or evening, into which the sun descended as into its grave, but out of which the new-born sun arose, or Horus was born of Osiris and Isis. With all her qualities of loveliness, fascination, and attraction, she was, by force of certain similes, represented as the insatiable monster craving for and swallowing up all life, and hence her extreme emblem, Death, or the Dragon, or most horrid monster of destruction. To quote the language of the Church, she was—"*Arma diaboli, via iniquitatis, scorpionis percussio, nocivum genus, sepulchri titulus.*" In this phase she was the type of death and destruction, hateful and devouring. In the Palenque Tablet and the Ferjérváry picture the phallus raises out of the yoni, which in turn rests upon the head of a devouring monster, or of a skull; either of which answers for the appropriate symbol intended.

THE RICHARDSON TABLET.

(See Figure xi.)

This Mound Builder relic was found by Mr. J. M. Richardson on the 31st day of January, 1879, in excavating a mound on the road leading from Wilmington, Ohio, to Harveysburg, known as the Wilmington and Waynesville Pike, about three and one-half miles from Wilmington. The bones with which the relic was found were decayed to a lime-like dust, but the teeth were yet preserved. The history of this find is contained in a pamphlet entitled "An Illustrated Description of Pre-historic Relics found near Wilmington, Ohio," published in 1879, by Dr. L. B. Welch and J. M. Richardson. This account was copied into the *American Antiquarian*, in the October number, 1881. The writer thinks there can be no doubt as to the genuineness of the Richardson Tablet. It is formed after the same general plan with the Gest Tablet, and serves to explain and interpret the latter. In it the picture is so plain that there can be no mistaking the key-fact intended to be displayed. Figure xi is a very exact reproduction of the tablet.

The picture is formed on a representation of the phallus, with testes, in the form of an inverted *Tau* cross. The testes form the base or bar of the cross. The left testis, as one looks at the repre-

FIGURE II.—THE WILMINGTON TABLET.

sentation, has the form of the male human head, male because of the chin-beard, the right one has the form of a female human head, female because of the side locks or curls. Thus under this form *man* and *woman*, or male female, is represented in one figure. So, also, from the general character of the tablet, the male head, with its abundance of hair, represents the *sun*, heat, and dryness, or earth, while the female head represents the *moon*, coolness, and moisture, or water. The male expresses active vitalizing energy, the female expresses passive receptivity. A strand of hair from the male head distinctly lines out the body or shaft of the phallus, and doing so turns and then returns on a line parallel to the first, back to the head. From the space occupied by the female head a line extends up vertically through the length of the phallus, and issues out of its summit in *waves of water* to the right and left, forming the expanse of the firmament. The space intermediate between the testes or bar and the heavens is divided into four quarters. In the first, on the female side, and next to the head, is to be found a shape like the crescent new moon. In the second, or the next above and on the same side, is a shape as of the full moon. In the third, on the opposite side at the top, is to be found a shape as of the moon in her third quarter. And finally, in the fourth, or in the compartment next to the male head, is to be found no moon at all, or the dead quarter. It will be observed that the quarter next to the male head contains a great quantity of its hair, a fractional portion of which extends up into the quarter above. The opposite quarter next to the head of the woman contains the rough outlines of a duck. The quarter above this shows a dead, leafless branch; while the opposite quarter at the top has, beside the strand of hair, a patch like a garden, and also waved curved lines as perhaps of wind. It would thus seem that beside the four quarters of the moon the slab is intended to represent the four seasons of the year. Spring, with the germinating heat rays and garden patch, summer heats by the mass of hair or rays of the sun, autumn by the duck, and winter by the leafless branch. It seems, moreover, that the figure in the summer quarter formed by the strands of hair is intended rudely to show the head of the goat sucker inverted, with its wide mouth and very short beak, the mouth wide open, as it is to be seen in the summer heats when catching insects. This bird, or, as it is commonly called, the bull-bird, has very few species or varieties; it is almost alone, exceedingly characteristic, and markedly a bird of the summer heats.

The tablet has some very peculiar number markings at the top, set, one part to one side, and on the lower part, to the left as you look at it, of the upper line, and one part to the other side and on the upper part, to the right as you look at it, of a lower line. Commencing in the center, and counting as we proceed toward the left, the *spaces* are 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, or ten spaces, while the *projections* between the spaces are 1, 2, 3, 4, 5, 6, 7, 8 and 9, or nine projections. On the other side, counting as we proceed from the center to the right on the lower line, we have 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, or ten spaces to the turn of the row of spaces and projections downward on the side, then there are two more spaces down the side, or 11 and 12, thus making a separation of the 12 spaces into 10 spaces and 2 spaces. By a like counting the protuberances are 1, 2, 3, 4, 5, 6, 7, 8 and 9, or nine protuberances, distinctly to the turn at the corner down the side, then two more, or 10 and 11, making eleven protuberances separated into 9 and 2. The description of spaces and protuberances is conventional, for they may be taken either way, with the same numerical results. By this, we have *two sums*, which added give 18, and multiplied give 81: also 9 and 12 which added give 21, the reverse of 12, and multiplied give 108: also, 9 and 11, which added give 20: also $9+10=19$, and $11+12=23$. The sum of these is 42, and their difference 6, and so on.

This tablet is of Waverly sand stone $3\frac{7}{8}$ inches wide, $4\frac{1}{8}$ inches long and $\frac{5}{8}$ inch thick. The reverse is unmarked save by 5 deep and 3 shallow grooves. It will at once be seen that the number forms which the markings are capable of forming, are singularly a repetition of the type measures, so much used in Mound Builder construction in the Ohio Valleys. Around the edge of the tablet, making of it an embracing cartouche, is to be found a long curiously wrought and armed arrow, or dart; and because of resemblance the writer is tempted to call attention to the Mexican ideograph or symbol of *Itz-co-atl*, or "Obsidian Serpent," pictured in Mr. Rau's Contribution in volume 22, of the Smithsonian Contributions, on page 51, as also to the explanatory text.

THE GEST TABLET.

(See Figure xii.)

This tablet is so remarkable as a work of advanced art that it can be ranked with those of Palenque and Copan. Examined carefully with those and it presents a likeness of artistic culture, a

sameness. So, too, it presents the same features which Mr. Rau notices as to the Palenque productions. He says: "Any one who examines the representation of the Smithsonian tablet will be struck with the want of symmetry of its sculptures and its incorrect (artistically) outline. * This asymmetrical appearance of the slab, is not at all owing to its restoration, as might be imagined at first sight, but simply to a lack of precision on the part of the sculptor. * * Though the bas relief figures on it show a commendable finish, the total aspect of the sculpture is not that of a well executed work, at least not in our sense. The Palenque Cross shows some incongruities in the proportions of its parts, and the glyphic signs and ornaments, are not disposed in an absolutely harmonious order. * * * The absence of accurateness in the execution of details observable at Palenque did not escape Morelet's critical judgment. 'The ruins of Palenque' he says 'have been perhaps too much eulogized. They are magnificent certainly in their antique boldness and strength, but I must say, without contesting their architectural merit, that they do not justify, in their details, all the enthusiasm of archæologists. The ornamental lines are wanting in regularity, the drawings in (modern artistic) symmetry, and the sculpture in finish.'" The artist had all the mental conceptions, but he lacked the perfect skill of the later Greek, or of our day, for the artistic perfection of his work. The work was "irregularly regular" to quote the apt expression of Mr. Gest; and so peculiarly so, as to confirm its genuineness. Perhaps the chief reason of all this was the lack of adequate instruments for working in hard stone. "Instruments of flint, or some other hard stone were much better suited for that purpose," says Mr. Rau, speaking of the obduracy of the stone of the Palenque Tablet. And, indeed, stone chisels were all the Mound Builders could have had for working the Gest tablet. Mr. Rau describes the tablet of the Palenque Cross as being $3\frac{1}{4}$ inches thick, and consisting of a hard fine grained sand-stone of yellowish gray color; the relief of the sculpture being $\frac{3}{16}$ of an inch.

As to material, the Gridley measure is likewise a hard fine grained sand-stone of yellowish gray color, $\frac{4}{12}$ths of an inch thick. The Gest tablet answers, for material, also to this description, though the grain of the stone may be a trifle coarser than that of the Gridley measure. The Gest tablet is $\frac{5}{8}$ths of an inch thick, and the relief of the sculpture is $\frac{3}{48}$ths of an inch, distinctly de-

fined even in detail, but not sharply. Had this tablet been found at Palenque it would have been taken as belonging to the Palenque material and style and culture.

On comparison, the general resemblance of the Richardson and Gest tablets will be at once seen. The Gest tablet, Figure xii like the Richardson, has the phallus and testes as the base of its representation, in the form of an inverted *Tau* cross. In place of the human heads for the testes those in the Gest tablet are represented by the labyrinths of ducts belonging to the organ, with a seed vesicle in the midst. These labyrinths unite by a ligament which continued forms the shaft of the phallus. At the summit a waved line or bar projects either way, in place of, and for, the waves of water in the Richardson slab. In the body of the phallus the seed vesicles are represented as developed to the stage of *embryo foe tuses*, and these again, are projected forth, or over to the sides, and are represented as in a further stage, viz., that of *four* weeks growth, or 28 days. This is shown in Figure xiii by the sketch

Figure xiii

of that period of development taken from a medical work. These projected foetuses are four in uumber, two on each side of the shaft, and are made to occupy the four quarters of the divided space, one to the quarter, in a similar manner with the occupancy of the like quarters, or compartments, on the Richardson slab, by the phases of the moon and the seasons of the year. It will be seen that the positions occupied by the foetuses, or the *men*, are always by contrast *reversed.** From the fact that the male or-

NOTE.—This reversal is evidently to signify the *double sex*. The same thing held in Hebrew esoterism,—for, the word for "*man*" contained the numbers 113 (diameter to a circumference of 355), the lunar year in days , whereas the word, or name, "*The-woman*" contained as the sum of its numbers 311, or the *reverse* of "man":—the two, together, as 113—311, being the division or unfolding of the number 226, which last was the sum of the numbers of the letters of the Hebrew expression Y'*sod Olaum*, or "*mystery of creation*", which was the name given to the location of the number 9 on the genitals of the *cosmic man* of Cabbalah (Ginsburg).

FIGURE 12.—THE CINCINNATI TABLET.

gan is made to show the office or function of the womb, the whole emblem is androgyne; nor does there seem to be any distinctive mark of sex, or unequal power, or quality, used either on the right or left of the shaft, save the reversal of position.

This slab like the Richardson, has number markings, distinct and clear. At the base of the Tau cross there are 6 distinct spaces and 7 lines, the spaces being broad. Beneath this and on the edge of the stone are 23 distinct, but small, spaces and 24 lines. The position of these 23 spaces is such that groups of them seem to be marked by the lines of the larger spacing, viz., 3, 7, 13, and 20. At the top there are similar markings, viz., 7 spaces and 8 lines, and 24 small spaces and 25 lines. In these the groupings are: 13, emphasized, and 20. In the whole sculpture there are 16 round dots or small circles, of which two are in the testes. In the body of the phallus there are 4, and continuing the count over, toward the right and left, respectively, we have 5 additional on each side, making a count of 9 and 9.

For the broad spacing and lines we have $6+7=13$, and $7+8=15$, together 28; and 13, the number of Catamenia in the year, multiplied by 28 equal 364, or the week year, while $28\times15=280+140=420$. Of this 280 days is 40 weeks or the period of parturition, while 420 is 210×2, and 210 days is called the period of *viability*. So, also, $6\times7=42$, or 21×2, and the reverse of 21 is 12. Or, these spaces and lines being 6, 7, 7, and 8, are together equal to $7\times4=28$. The smaller spacing and lines give us $23+24=47$, with $24+25=49$, or together 96 (or 24×4, or 12×8).

Thus we have the exact description of these tablets. The numbers shown on these are familiar as those used in the measures of the Mound Builder works in which the tablets were found; also as periods of lunar and solar time, and especially lunar time, as marking the natural periods of menstruation, quickening, viability, and gestation The relationship becomes closer when we find that the Gest Tablet, as to its size, has special measures from the same unit or standard with the Gridley stone; they are: length, 5 inches; least breadth, 2.50 inches; greatest breadth, 3 (2.99) inches, with two chords of 4.50 inches each.

THE CLARKE TABLET.

(See Figure xiv.)

Another and very late *find* is fortunate, timely, and of great value, as confirming the genuineness of the Richardson and Gest Tablets. It is what is to be known as the "Clarke" (or Waverly) "Tablet," now the property of Mr. Robert Clarke, of Cincinnati. It is presented in Fig. xiv. On the left side, as one looks at it, are to be seen the unmistakeable *fac-similes* of the fœtus images of the Gest Tablet, while on turning the plate, so as to have the top on the right hand and side, the presentation exhibits the *fac-similes* of the involved duct labyrinths of the *testes* in the same tablet. In this, however, the shaft seems to be changed to represent the yoni.

This tablet was discovered March 12, 1885, by Mr. J. P. MacLean, in the collection of Dr. W. R. Hurst, of Piketon, Ohio, was obtained of him and disposed of to Mr. Clarke. The tablet was broken in two pieces, which Mr. MacLean found, piece by piece, in the collection. The history of the tablet, as given by Dr. Hurst to Mr. MacLean, is as follows: "The tablet was taken from a mound on the farm of Abraham Cutlip, about one mile south of Waverly and about three and one-half miles north of Piketon, about March, 1872. It was found about three feet from the bottom of the mound, on the north side, by Abraham Cutlip and David Allen, who were cutting away the mound. Dr. Hurst obtained it from them while they were at work. The mound was on the second bottom of the river, had been fifteen to twenty feet high, but had from time to time been cut away, so that it was only about ten feet high at the time of this excavation. The mound was composed of clay. With the tablet were found 'darts, badges, and human bones.'"

There can be no doubt of its genuineness, and for this reason it is of very great value as corroborative of not only the authenticity, but also the reading of the Gest and Richardson Tablets.

If we now refer to the Gest Tablet for comparison, we will find that it is, in its main or essential features, the same with the Palenque Cross and the Ferjèrvàry picture. In all cases we have the tree of life, with a human being (Androgyne) standing upon either side. In the Ferjèrvàry picture the phallus. rising out of the yoni, has seven branches on each side; the phallus at the top bifurcating into two branches (for water waves), extending out on

FIGURE 14.—THE WAVERLY TABLET.

either side, and these, again, are separated into further subdivisions, etc. In its frame, on the three sides thereof, we have for markings 3 twelves, or 36 in all, distinctly done. By reference, for similar pictures for similar showings, on the Asiatic Continent, to Dr. Inman's "Ancient Faiths embodied in Ancient Names," we will find identity of design. (See his illustrations in Vol. I. on the cover, and on pages 156 and 160, with his explanations.) In these illustrations notice the numbers of bunches of *flowers* to mark the catamenia, so arranged as to make 13 by a count of 6 plus 7, also the numbers 18 and 21. He himself notices the number 13. "This number suggests an explanation. At every lunar period the female has an affection which by its regularity has received the name of menses, or Catamenia, and there are 13 of these periods in the year." Notice also, in Vol. II., p. 648, the phallic and yoni symbols of the Christian Church. One of these represents a monk so marked as to show a man's head with a fish's body. There are 12 marks forming the fish. He holds a string of beads, 7×2 or 14 of which are seen. She, standing in an alcove formed by the sun, the mouth of the vagina (*vesica piscis*), holds a string of beads 13 in number, and so arranged as to count 5 and 6 and 7. The rays of the sun are arranged so that 18 are seen, and these grouped to form 10, 3. and 5. There are two more but covered rays, making 20 in all. In Sharpe's Egypt one will find the tree of life, a woman in the branches pouring water. It is inverted, so that the roots are in place of the branches, the shaft projecting into the ground (Isis). All these refer to a like symbolization. The fact is, that having caught at the root ideas, or natural basis of symbolic language, our literature is full to repletion of scattered fragments, which can be gathered, collected, recognized, and referred to a whole, or perfect ancient mode of communication.

There is remarkable harmony between the number indications on these slabs with the mound measures and the Gridley standard of measure by which the mound works were constructed. But likewise there is such harmony between the measures of time indicated by these numbers and the calendar forms of the Mayas that attention is called to the fact. It is to some extent agreed on that there is connection between the Maya culture and that of the consructors of Palenque and Copan. Reference is now made to "The Maya Chronicle" by D. G. Brinton, M. D., Philadelphia, 1882. He says: "The Mayas had a mathematical turn, and

possessed a developed system of numeration. It counted by *units* and *scores;* in other words it was a *vigesmal* system." The cardinal numbers commenced with *one* and closed with *twenty*. From twenty upward the *scores* are used, as "one to the score equals 21," and so on. Now as to their calendar. Their year was divided into 18 months of 20 days each, or 360 days, to which, to make 365, *five* days called "days without names" were added. "But the calendar was not as simple as this. The days were not counted from 1 to 20, and then beginning at 1 again, and so on, but by periods of 13 days each," the 14th day beginning a new week. "28 of these weeks make 364 days, thus having 1 day to complete the tropical solar year. When the number of these odd days amounted to 13, in other words when 13 years had elapsed, this formed a period which was called 'a *katun* of days'. It will be readily observed by an inspection of the following table, that 4 of these indictions, in other words, 52 years, will elapse before a 'year bearer' of the same name and number recommences a year. A cycle of 52 years was thus obtained in a manner almost identical with that of the Aztecs, Torascos, and other nations." "20 days were a month, and 20 years was a cycle *katun.** This katun was divided into 5 lesser divisions of 4 years each. They also had a *katun* of 24 years. They had a great cycle of $13 \times 20 = 260$ years, called an *Ahau Katun*, or $13 \times 24 = 312$ years. The Maya Chronicles make from the earliest time to the coming of the Spaniards 71 katuns, which equal either 1420 or 1704 years, according to the katun used of 20 or 24 years." It seems quite evident that the great cycle of 312 years was composed of 6 cycles of 52 years each.

The peculiar make up of these calendar data brings out in relief a series of numbers, which are so connected with the Mound Builder system of measures, and the tablets spoken of, that it may at least be suggested of them that they point to a common system of use. $13 \times 28 = 364$ is the catamenial year, and 28 days would, because of being a catamenial period, be a holy week of 4 periods of 7 days each; the number 7 being "*holy*" because it was the base of so many periods of generative time, as, 28, 126, 210 and 280 days.* It is thought this conclusion is justified by the showing of the phallic system every where among all nations of antiquity. We have $6+7=13$ and $6+7+7+8=28$, on the Gest tablet. 28 is 4 times 7, and $52 \times 7 = 364$, showing a co-ordinating mode of

*Note. It seems remarkable, that this word *Katun* for a small cycle is the same with the Hebrew *katon* or *little*. It is evident that, because the phases of the moon run so co-ordinately with the generative periods, it was supposed to be the *intelligent cause*, and was therefore worshiped.

counting time, especially in the priestly or sacerdotal way, founded on the idea of phallic creative growth by periods of 7, viz., $4\times 7=28$, of *menses*, $7\times 18=126$, of *quickening*, $30\times 7=210$, of *viability*, and 40×7 (or $28\times 10)=280$, of *gestation*, and $52\times 7=364$, the holy, or week year. So, also, in the great characteristic measures of the Mound works, viz., 1050 and 1080, we find a mode of the use of a year cycle founded on $52\times 6=312$, for, $105+108=213$, which is the reverse of 312 and indicates it by the Mound Builder custom of reversed numbers, and again, 213 of itself is 6 times 355 the numerical value of the lunar year in days. $355\times 6=213$, and 312 is a great cycle of 52×6.

The writer considers himself very fortunate to be able to close this paper with a fact of discovery in Yucatan, by Dr. Augustus Le Plongeon and his estimable and brave wife, of Brooklyn, New York. When they made the remarkable discovery of the sepulchre of the royal Kan Coh, at Chichen-Itza, they found therein a great number of personal ornaments. These consisted of worked arrow and spear heads, of fine quartz and serpentine, with shell beads, and extraordinary ornaments in jade, of marvelous polish. The point of great interest as to these is this, that though the Mayas had arrived to the great advance in civilization of splendid stone cutting and mason work and sculpture, with an elaborate hieroglyphical alphabet—an advance parallel to that of the old Egyptians and Babylonians— yet their articles of personal ornamentation *were the same* (of the same kind, material, and design) *with those of the Mound Builders of the Ohio Valley*. The labors of Dr. and Mrs. Plongeon in Central America are the most valuable of all others, and their results are so surprising, and so promising of the discovery of "*missing links*," that they should be furnished with material efficient support by the Government in the further prosecution of this wonderful field of their self-sacrificing personal investigation.

J. RALSTON SKINNER.

NOTE. *Erratum.* In a note to a former article 5011506 is said to be the square root of 51215, whereas it should be 251152.

PROTOZOA OF THE CINCINNATI GROUP.

By JOSEPH F. JAMES, *Professor of Botany and Geology in Miami University.*

(Read September 6, 1886.)

The term Protozoa is applied to those members of the animal kingdom which are "generally of minute size, composed of a nearly structureless jelly-like substance (termed 'sarcode') showing no composition out of definite parts or segments, having no definite body-cavity, presenting no traces of a nervous system, and having either no differentiated alimentary apparatus or but a very rudimentary one."*

On account of their jelly-like nature they are difficult of preservation in a fossil state, and, when found, present a structure which can only be examined by means of microscopic sections. Only two orders have as yet been found fossil in this vicinity, and these only in limited numbers. The first contains one genus and one species, and was formerly placed with the Polypi. The second includes eight genera and eighteen species. The following is the first attempt which has been made to collect the descriptions of genera and species and arrange them in any order:

Sub-kingdom PROTOZOA.

Order. FORAMINIFERA.

Minute, structureless, gelatinous animals, with the body protected by a shell generally composed of carbonate of lime. Pseudopodia long, filamentous, and interlacing.

Living *Foraminifera* are microscopic, and distributed in immense beds at the bottom of the ocean. As fossils they are found through all the formations from the Silurian to the Quaternary. They go largely toward making up the chalk formation, and in the Eocene Tertiary formed beds known as the Nummulitic limestone, which stretch from Western Europe to the frontiers of China (Nicholson). Only one genus seems yet to have been found in the Cincinnati group, although both *Receptaculitis* and *Stromatopora*, have been referred here. The genus now placed in this order is BEATRICEA, and it has been assigned various posi-

*Nicholson Manual of Zoology, p. 44.

tions by different authors. It was originally described as a plant; then grouped with the corals; Prof. Hyatt, in 1865, called it a mollusk allied to the Cephalopoda, and in 1884 considered it as one of the Foraminifera.

Genus 1. BEATRICEA, Billings, 1857.

Rept. Prog. Geol. Sur, Canada, 1850 56; Toronto 1857, p. 343.; A. Hyatt, Jr., 1865 Am. Jour. Arts and Sciences, 2d Series, XXXIX, p. 261 *et seq.*, Pro. Am. Asso. Adv. Sci., XXXII, (1884), p. 492.

Nearly straight, one to fourteen inches in diameter, perforated by a cylindrical and nearly central tube, which is transversely septate; outside of tube composed of numerous concentric layers.

1. B NODULOSA, Billings, 1857.

Loc. cit. p. 343.

Surface covered with oblong, oval, or sub-triangular projections one to three lines high, with rounded, blunt points nearer one end of the prominence than the other; projections varying in size, sometimes with a nearly circular base, sometimes six or seven lines long and one-half as wide, distant one to three lines from each other, arranged in rows or spirals; whole surface fretted with minute points, showing perforations when worn. Septa thin, very concave, one line to one inch apart.

Locality. Originally described from Canada. Found in Marion County, Kentucky.

2. B. UNDULATA, Billings, 1857.

Loc cit. p. 344.

Surface sulcated longitudinally by short, irregular, wave-like furrows, from two lines to one inch across; otherwise like the preceding. Specimens have been found ten feet five inches long and from eight to fourteen inches in diameter.

Locality. With the preceding.

These two species have, by some writers (Knott, Geology of Marion County--Kentucky Geological Survey, p. 32) been considered one species. Prof. Hyatt, however, considers them distinct, and says they can be separated by the internal characters.

Order. SPONGIDA.

One of the lowest orders of animal life, consisting of an aggregation of animalculæ forming a soft mass with spiculæ of various forms, or possessing a silicious skeleton filled with sarcode. This sarcode is traversed by tubes of varying size, serving to convey nourishment to the individuals.

As fossils, they occur in amorphous masses of irregular shape and variable size, showing little or no structure on the exterior beyond the tube openings or osculæ, internally often of layers of matter separated by interlamellar spaces, the tubes penetrating these vertically. The internal structure can only be studied by means of thin sections, examined under the microscope.

The remains of a number of genera have been found in the rocks of the Cincinnati Group. The ten described genera are here reduced to eight, but no account is taken of those which have been named and not described. The following keys and descriptions are offered as a contribution to the study. The number of species will no doubt be increased on a further study of more material.

SYNOPSIS OF GENERA.

I. FREE, IRREGULAR OR SPHERICAL: EXTERNAL OPENINGS TO PORES MINUTE OR WANTING.

a. Surface without plates.

Round, unattached, with minute external pores.
1. Astylospongia.

Irregular, generally compressed, and having the appearance of a number united in a cluster. 2. Pattersonia.

Body circular, with arms. 3. Brachiospongia.

b Surface covered with plates.

Having an apparent base: plates polygonal or hexagonal, without special arrangement. 4. Pasceolus.

Plates imbricated, arranged in concentric, intersecting lines.
5. Ischadites.

Plates cylindrical, blunt; arranged in concentric lines.
6. Receptaculites.

II. INCRUSTING: EXTERNAL PORES CONSPICUOUS.

Formed of thin layers or laminæ; pores with external openings (osculæ). 7. Stromatopora.

Formed of thin, irregular laminæ; tubes without walls, perforating laminæ and interspaces, but not continuously.
8. Stromatocerium.

Genus 1. ASTYLOSPONGIA, Roemer. 1860. Die Silur. Fauna des West Tenn., p. 7.

Microspongia, Miller and Dyer. 1878. Jour. Cin. Soc Nat. Hist., I., p. 37.

Globular, nearly regular, free: large canals running from the center outward, intersecting smaller, concentric canals: internal structure stellate, the rays cohering; spiculæ (?) small, star-like objects in the midst of the mass.

1. A. GREGARIA, Miller & Dyer.

Microspongia gregaria, M. & D. 1878. J. C. S. N. H., vol. I., p. 37; pl. 2, fig. 2.

Chætetes subrotundata, U. P. James, 1878. The Palæontologist, p. 1.

Astylospongia subrotundata, U. P. James. Ibid, p. 11.

Globular, compact, sometimes as if two or three united into a cluster: one-quarter to three-quarters of an inch in diameter: needle-shaped spiculæ (?) visible under high magnifying power.

Locality: Cincinnati; Ogden Station, Clinton County, Ohio.

The characters given for *Microspongia* are not sufficient to separate it from *Astylospongia*. *A. subrotundata*, James, was first referred to *Chætetes* (as above), but afterward placed in *Astylospongia*.

2. A. TUMIDA, U. P. James, 1878. The Palæontologist, p. 1.

Sub-globose, depressed, with a cavity on one side; surface rough, pitted, sometimes lobed.

Locality: Cincinnati.

Genus 2. PATTERSONIA, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p. 43.

A solid, amorphous mass of uniform structure, and destitute of openings: surface irregular; often appearing as if several specimens were united in a cluster.

P. DIFFICILIS, S. A. Miller. Ibid. p. 43. Pl. 2, figs. 3, 3 *a*.

Character of the genus. The only species known. It may, on further examination, prove to be a *Stromatopora*.

Locality: Cincinnati, O.

Genus 3. BRACHIOSPONGIA, Marsh, 1867. Am. Jour. Sci. and Arts. Series 2, vol. XLIV., p. 88.

Body nearly hemispherical; arms extending out from lateral surface; hollow, with arms opening into the body cavity.

1. B. DIGITATA, Owen.

Scyphia digitata, Owen. Second Report on Geology of Kentucky, p. 111.

Body hollow, cup-shaped, with from eight to eleven tubes or arms: arms extending horizontally one inch, and then rising vertically; body six to twelve inches in diameter.

Locality: Frankfort, Ky.

This is probably a Trenton species, and is not likely to be found in this locality. It is inserted here because it has been included in catalogues of the fossils of this group.

3. B. TUBERCULATA, U. P. James. 1879. The Palæontologist, p. 25.

Body sub-circular, with prominent tubercles irregularly distributed over the surface; arms, nine, straight; one, to three and a half inches long; specimens between five and six inches in diameter.

Locality: Todd's Fork, near Wilmington, Ohio.

Two other species, viz., *B. lyoni*, Marsh, and *B. roemeriana*, Marsh, though given in catalogues, seem never to have been described. These names can not, therefore, hold.

Genus 4. PASCEOLUS, Billings. Report of Progress of Geological Survey of Canada, 1853-56, p. 342. Palæozoic Fossils of Canada, 1861, p. 392. S. A. Miller, 1874, Cin. Quar. Jour. Sci., vol. I., p. 4.

Ovate or sub-globular. Exterior surface marked by pentagonal or hexagonal plates; base with or without point of attachment.

1. P. GLOBOSUS, Billings. *Loc. cit.*, p. 343. Palæozoic Fossils, p. 392, figure.

Hemispherical or sub-globular: two or three inches in diameter; base flattened; plate impressions polygonal or hexagonal, without external orifices, and about two lines in diameter.

Locality: Cincinnati; Ottawa, Canada.

This is mainly a Trenton species. It has been found in this vicinity in a few localities.

2. P. DARWINII, S. A. Miller. 1874. Cin. Quar. Jour. Sci., I., p. 5; fig.

P. claudii, S. A. M. Ibid., p. 6, fig.

Body spherical or hemispherical; some specimens with a circular central depression; surface marked with crowded pentag-

gonal or hexagonal plates, one line or less in diameter; diameter of fossil from one-half to one and one-quarter inch.

Locality: Cincinnati, O.; Maysville, Ky.

The form described as *P. claudii* is apparently a young and small specimen, without the circular depression.

Genus 5. ISCHADITES, Murchison. 1839. Siluria, p. 697.

Lepidolites, Ulrich. 1879. Jour. Cin. Soc. Nat. His., vol. II., p. 20.

Ovate, conical or cylindrical, often compressed; outer surface, with plates arranged in concentric, intersecting lines, like the engine turning on a watch case.

I. DICKHAUTI, Ulrich. J. F. James, J. C. S. N. H., VIII., p. 163.

Lepidolites dickhauti, Ulrich. 1879. Jour. Cin. Soc. Nat. Hist., vol. II., p. 21, pl. 7, figs. 17, 17 *a* and *b*.

L. elongatus, Ulrich. 1879. Ibid, II., p. 22, pl. 7, fig. 16.

Compressed from a spherical or sub-pyriform body, with lower portion indented; plates imbricated, about three times as long as wide, with widest end round, exposed, and arranged in concentric, intersecting lines.

Locality: Covington, Ky., about 150 feet above low water mark.

Genus 6. RECEPTACULITES, De France. 1827. Dict. Sci. Nat., t. 45, atlas; p. 68.

Anomaloides, Ulrich. 1878. Jour. Cin. Soc. Nat. Hist., vol. I., p. 92.

Hollow, sometimes cup-shaped, with plates radiating in curved lines as in ISCHADITES; numerous cylindrical bodies between the outer plates and the inner, thin, expansion,

R. RETICULATUS, Ulrich. J. F. James, Jour. Cin. Soc. Nat. Hist., vol. VIII., p. 165,

Anomaloides reticulatus, Ulrich. 1878. J. C. S N. H., vol. I., p. 92, pl. 4, figs. 6, 6 *a b*.

Compressed, hollow; formed mainly of elongated, cylindrical bodies, sharp at the inner and rounded at the outer ends; arranged in intersecting lines.

Locality: Covington, Ky.

This and the preceding species were long of uncertain position. There seems little doubt but that they are here referred to

their correct genera. Compare with Billings "On RECEPTACULITES" (Palæozoic Fossils of Canada, I., p. 378) and Hinde in Jour. Geol. Soc, Lond. Nov. 1884 p. 395, et seq.

Genus 7, STROMATOPORA, Goldfuss. 1826. Petrefacta Germaniæ. Nicholson & Murie. 1877. Jour, Linn. Soc. of London. Zoology, XIV., p. 217. Geol. of Ohio, Palæont. vol. II., p. 245.

Dystactospongia, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p. 42.

"Skeleton ('sarcodeme') consisting of concentric calcaerous laminæ, separated by distinct 'interlaminar spaces,' which are crossed by numerous 'radial pillars.' In some cases there are radiating water canals and surface grooves placed round minor centers. Sometimes there are seen on the surface the openings of large water canals ('oscula').

" Forming irregular masses, sometimes with a foreign body as a nucleus; spreading out into extended expansions, covered inferiorly by a thin, striated, calcareous membrane ('epitheca'), or growing in thin layers parasitically upon foreign objects." Nich. and Murie on "Stromatopora and its allies." Ibid.

The position of this genus has been the subject of much controversy, and the matter is by no means yet settled. It has been placed with the Polyps and with the sponges, but late writers are inclined to regard it as the type of a separate order. See Nicholson and Murie, Ibid, and others. The following is an arrangement of the species of this group:

a. Massive forms.

1 S. INSOLENS, S. A Miller.

Dystactospongia insolens, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p 43, pl. 2, figs. 2, 2 *a b*.

Massive, irregular in form; outer surface, with radiating canals; internal structure minutely vesicular.

Locality: Cincinnati.

This species closely resembles *S. granulata*, Nicholson and Murie, as described and figured by them in the article referred to above. See their figure, Pl. 1, fig. 11.

b. Tubular forms.

2. S. TUBULARIS, U. P. James. 1884. Jour. Cin. Soc. Nat Hist., VII., p. 139, pl. 7, figs. 3, 3 *a b*.

Cylindrical or tubular, two, to two and one half inches in diameter, and one inch long; laminæ about one-twentieth of an inch in thickness, irregular, wavy, with serrate edges; interspaces thin; pores (oscula) at irregular intervals; center of the tube filled with clay, broken shells, or corals.

Locality: Cincinnati; Morrow, O.

3. S. SUBCYLINDRICA, U. P. James. 1884. Jour. Cin. Soc. Nat. Hist., vol. VII., p. 20, figs. 1, 1 *a*, *b*, *c*.

Labechia montifera, Ulrich. 1886. Contri. to Palæon, Vol. I., p. 33, pl. 2, figs. 9, 9 *a b*

Subcylindrical; exterior surface covered with prominent conical elevations, one-tenth to one-twentieth of an inch high, irregularly distributed; apices and slopes of these with radiating lines or depressions; spaces between the monticules covered with circular or elongate, papillæ, one-twentieth of an inch apart; no surface pores; specimens, two and one-half inches long, curved.

Locality. Morrow and Clarksville, O.; Madison, Ind.

For the resemblances between this species and *Lebechia montifera*, see J. C. S. N. H., IX., No. 2, p. 39.

c. Incrusting forms.

4. S. LICHENOIDES, U. P. James. 1878. The Palæontologist, p. 18.

Expansions thin, on shells; one-eighth to one-quarter of an inch in diameter and one-quarter to one-half line in thickness; surface rugose or undulating, with small, irregular pores.

Locality: Cincinnati.

5. S. SCABRA, U. P. James. 1878. The Palæontologist, p. 18.

Expansions (on shells) thin; surface rough, with conical or elongated monticules, one half to one line above the surface and one to two lines apart.

Locality: Lebanon, O.

6. S. PAPILLATA, U. P. James. 1878. The Palæontologist, p. 1.

Crust thin; surface, with small, closely set papillæ, irregularly arranged, six or eight to a line; apices open or closed.

Locality: Cincinnati; Clinton County, O.

7. S. LUDLOWENSIS, U. P. James. 1884. Jour. Cin. Soc. Nat. Hist., vol. VII., p. 140; figures.

Expansions two by four inches; incrusting or in irregular, amorphous masses; surface irregular or rough; laminæ thin; pores

circular or oval, irregularly distributed; numerous minute pores, and a greater or lesser number of larger oscula.

Locality: Ludlow, Ky., etc.

This species shows there is no definite line to be drawn between the massive and incrusting species of the genus.

Genus 8. STROMATOCERIUM, Hall. 1847. Pal. of New York, vol. I., p. 48; emended by Nicholson and Murie, Jour. of Linn. Soc., London (Zoology), 1877, Vol. XIV., p. 222.

Skeleton massive, composed of dense, thick, calcareous, horizontal and concentric laminæ, separated by narrow and irregular interspaces; laminæ irregularly disposed; no radial pillars crossing interlaminar spaces; entire mass perforated by vertical tubes without walls, at short and irregular distances; the tubes place the interlaminar spaces in communication, but cannot be said to run from top to bottom.

1. S. CANADENSE. Nich. & Murie, 1877. Ibid, vol. XIV., p. 223, pl. 3, figs. 9, 10.

S. rugosum. (?) Hall, 1847. Pal. of N. York, vol 1. p. 48, pl. fig.

"Skeleton having the form of large, rounded or irregular masses, conspicuously composed of numerous dense, concentric laminæ, about five of which (with the interlaminar spaces) occupy one line. The interlaminar spaces are open, without radial pillars. and the mass is traversed by numerous discontinuous, vertical canals, from $\frac{1}{50}$ to $\frac{1}{80}$ inch or less in diameter. Surface characters unknown."

Locality: Peterborough, Ontario.

2. S. RICHMONDENSE, S. A. Miller. 1878. Jour. Cin Soc. Nat. His., vol. V., p. 41, pl. 2, figs. 1, 1 *a b*.

Small, globular, hemispherical, irregular; laminæ irregular, more or less wrinkled, filled with minute tubes, surface apparently destitute of openings.

Locality: Richmond, Ind.

REMARKS ON A VARIETY OF NOSTOC PRUNIFORME.

By Geo. B. Twitchell.

(Read October 5, 1886.)

Early last spring the Society received, under the name of "Agates in an inception stage," a bottle of nostocs collected at Haidley, Idaho. In August I received another lot of the same. This idea of their connection with agates is readily explained by their appearance, for they surely bear both externally and internally a marked resemblance to the agate pebbles found in some of the western streams.

The various species of the genus nostoc are generally found in water or damp places as more or less firm gelatinous masses. These thalli vary for the different species, some being almost microscopic while others cover over a square foot of moist sand. Some are indefinitely expanded, while others are restricted by a sort of periderm to a more definite shape.

Inside of these gelatinous masses will be found serpentine rows of roundish cells, with here and there larger cells of a different color, called *heterocysts*. These filaments are usually, if not always, inclosed in sheaths to which the heterocysts adhere by their sides. The growth of these filaments is by a cell division. According to Thuret the reproduction is in this manner: The thallus becomes softened and a green jelly escapes. This is made up of detached portions of nostoc filaments that have straightened out. These have an oscillaria-like motion. They are sensitive to light, always accumulating at the brightest part of the vessel containing them. In the development of one of these *hormogones*, as they are called, the first change that takes place is the formation of a distinct gelatinous sheath about the whole of the filament. When this is formed the inclosed cells divide once or oftener, the plane of the division being parallel to the original direction of growth. The result is two or more rows of cells in a now rather distended sheath. By a reuniting of these cells a single curved nostoc filament is formed within a sheath which has now shortened and widened to a more globose form. This young nostoc secretes jelly and grows until it reaches the size of the parent. The existence of a reproduction by means of spores has been suggested by

some writers. However, it is not well understood, and, indeed, it seems probable that we are still far from a correct understanding of the whole life of these strange plants. Many may be conditions of higher plants, while the resemblance that the gonidia of certain lichens bear to the nostoc filament has given rise to much discussion as to the part our plant may play here.

Although this agate-plant hardly agrees with any of the described species, yet in the present state of our knowledge of the genus, it is not advisable to consider it an entirely new species. We will consider our plant a variety of *Nostoc pruniforme.*

The size is quite variable; the largest observed were about an inch and a half in diameter. The jelly is remarkably firm and is inclosed in a leathery periderm. The shape may be called globose. In the central portion of the thallus the filaments are curved in the characteristic nostoc manner, but, running out from here, they are arranged in almost straight lines radiating toward the periphery, when they are again twisted and tangled, probably thus helping to build up the periderm. The cells are more variable in size than those of the typical *Nostoc pruniforme.* No sheath can be seen in a vegetating specimen. The manner of reproduction is similar to what has been described for other species, with the exception that the whole process takes place within the parent thallus, the *hormogones* not even breaking loose from adjoining cells. The same filament frequently has different portions in all the different stages of the reproductive process.

The reproduction was observed in specimens collected in August, the first step being the development of sheaths about portions of the filaments. The cells inclosed then divide into rows of cells after the manner described by Thuret. In reuniting these cells do not seem to observe the regularity described for other species, but the result is the same.

Among the twisting filaments of the central portion of the thallus, the *hormogones* while forming are naturally very irregular in shape. When fully formed they are nearly spherical, and the inclosed cells are so closely pressed together that the regular filaments, which could be traced before this stage, cannot be made out. It seems probable that the parent must decay before these young plants can develop into full grown nostocs. Whether or not these are now in a condition to pass through a resting stage, I cannot say.

In the straight filaments leading out from the center, the *hormogones* in forming are not so irregular in shape as those just described. Near the periphery they are developed in great abundance. When fully formed they are not made up of a mass of closely united cells, but are young plants in which the characteristic twisting filaments can be distinctly seen. In some cases these young nostocs will be found at the very outer edge of the thallus, and it is not uncommon to find such a plant covered with other small but fully formed plants. It would seem probable from this that the *hormogones* that are formed near the periphery can develop into independent thalli before the entire dissolution of the parent.

There were many things of interest about this collection not directly connected with the nostocs. In almost every case the plants were covered with layers of carbonate of lime deposited from the water in which they grew. Quite a number of diatoms were found in the sediment at the bottom of the bottle, and occasionally one would be found inclosed in one of the masses of jelly. Irregular, whitish spots would quite frequently be found scattered through the gelatinous matter, but strangest of all were the bodies observed by Mr. G. H. Curtis. I can best describe them by saying that they appeared like multitudes of pins with their points all directed toward a common center, where they became so numerous that the individuals could no longer be distinguished. He considered them raphides. I cannot close without at least mentioning that bacteria were found in great abundance in some specimens that had become a little softened by decay. The gelatinous matter of the thallus seemed to make an excellent culture medium.

OBSERVATIONS ON PHOTOGRAPHIC APPLIANCES AND THEIR USES.

By L. M. Petitdidier.

(Read by title December 7, 1886.)

It may seem presuming on my part to offer a statement of my observations on photographic appliances to members of this Section, who have had as much, and in some cases more, experience than myself. However, if I fail to say anything of interest, you can only blame the Committee on Entertainments for their selection. My remarks will only apply to amateurs, and only relate to our general work.

Every one will readily admit that good negatives can not be obtained without a good photographic outfit, used with judicious manipulation and precision. A negative or photograph should be judged from two standpoints, one being the technical and the other the artistic; the successful combination of both constitutes perfect work. One can become artistic in his selections and general adaptation of his subject to his plate almost as well as he can become technical.

This may seem to be an exaggerated statement, but I am fully convinced that a close study of artistic effects would show that these are more or less subject to well-defined rules and conventionalities, which could be memorized, just as one learns his multiplication table.

A picture which is artistic and not well executed is in part a failure; therefore to be successful it is as essential to be a careful manipulator as it is to possess artistic attainments.

I shall confine myself to the technique of photography, and give you the result of my conclusions, let them be worth what they may.

In the selection of an outfit, let us take up the camera first—I mean the kind mounted on a tripod. A number of various boxes, nicely finished and very pretty in appearance, are always in the market, which answer all requirements. Whatever their adjustments may be, two of these are indispensable—they are a rising front and a vertical swing-back. Other adjustments, such as focusing rack and pinion, etc., are only for convenience, but they are very useful. A horizontal swing can be of much service

in some peculiar cases where one side of the view is much nearer than the other. For general use, however, they are not only of no value, but lessen the rigidity of the back of the box, besides leading to complications. My advice would be, leave horizontal swings alone, and I believe that those members of this club who have used them will concur in my opinion.

The size of a camera, which is the most desirable for any one, depends somewhat on the weight one is willing to carry, and also on the film-carrier to be used, whether glass or paper. It is very evident that if paper is to be used instead of glass plates, one can afford to carry a camera of larger dimensions. The energy and vital resources of the amateur are also to be considered in the determination of the size to be adopted. Some amateurs can carry a 11x14 box, with two dozen plates, on a warm summer day without murmuring, while others might become fatigued from carrying a quarter size box. Of course, I presume that every photographer is personally concerned in the transportation of his own traps.

The proportion of the plate to be used depends on the topographical features of the country in which the views are to be taken, and also on the disposition to be made of the negatives, whether intended principally for prints or for lantern slides. If intended for prints, and in sections of country where no high mountains are to be dealt with, a plate having the proportions of 5 to 8 or 5 to 7 is well suited, as the height desired is much less than the breadth; thus in most cases we find that when seven or eight inches are sufficient for the lateral dimension, five inches give ample margin for sky and foreground.

On the other hand, if we consider that we get as much and perhaps more enjoyment out of our work by transforming it into lantern slides, and that the shape of a lantern slide gives a better image on the screen when about square, we conclude that the heighth and width of a plate should not differ much, though there should always be a difference in order to allow of horizontal and vertical views. Besides, square pictures are seldom graceful. My observation has led me to believe that the proportions of 5 to 7 or 6½ to 8½ are the proportions which can be adapted most satisfactorily to any kind of country or view, and are at the same time well proportioned for lantern slides. In the latter case the ends of the negatives can be cut off so as to give the view better shape, as it must be observed here that a lantern slide need not embrace as

much as a print, which is examined for a longer time. In fact, too many details detract from the appearance of an image on a screen, the principal features of which are alone of interest.

Detective cameras using quarter size plates are only good for studies, instantaneous views, and lantern slides. Prints made on such a small size are insignificant; objects and details are so minute as to be almost microscopic; furthermore, the perspective suffers very much. Any one can be convinced of this fact by looking through a slide and comparing its perspective with that shown when its image is thrown upon a screen. In fact, a 4x5 picture is the smallest admissable that will give details and perspective without tiring the eyesight. Amateurs making that size exclusively will find it quite convenient and at the same time quite a luxury, when looking over their pictures, to use a graphoscope magnifying about two diameters. By being magnified a picture gains in depth and perspective; shadows become transparent, and details are observed which otherwise escape the naked eye.

Concluding, therefore, that 4x5 is the minimum size plate which will produce anything like a fair picture, the maximum size need not exceed 6½x8½, unless the amateur is very ambitious, and if so, after having acquired all the paraphernalia accompanying photographic work, he may regret his enthusiasm, and soon have a camera and lens for sale.

I have said nothing pertaining to portrait work, as it is not within the province of an amateur, who is not prepared for that class of work, and therefore can not do it as well as professionals, who devote a lifetime to it. When portraits are wanted, however, any size plate can be used. By portrait work I refer to such work as done in photograph galleries.

SELECTION OF LENSES.

Though there is a great variety of lenses used in photography, the amateur limits himself to two kinds—the single view lens and the rectilinear doublet. The single view lens is corrected for everything except what is called barrel distortion. This distortion is very apparent when long, straight lines are brought into view. Any straight line not passing through the center of the field of the lens will be carried more or less toward the center of the picture, and this distortion is greatest at the edge of the field. This lens is therefore not good for architectural subjects, or any view in which appear near buildings of large dimensions. It is said, however,

to be better for general landscapes and views than any other lens, as it gives more brilliant results, owing to its non-correction for barrel distortion, and partly, also, because the rays of light have a smaller number of lenses to go through. They are cheap, and every outdoor photographer should be the owner of at least one of them.

The rectilinear lenses most in use and in the market include a very wide angle lens and one whose angle corresponds nearly with the angle which an artist uses when painting outdoor views, landscapes, etc.

A lens is said to be rectilinear when it reproduces straight lines correctly. Therefore, a rectilinear lens must give the true perspective as seen from the point of view occupied by the camera at the time of exposure. Wide angle lenses are specially useful when making views of interiors and confined situations, but for short exposure and instantaneous views more especially they are not so well adapted as the other double combination, as they have not more than one-half their rapidity.

In order to get a good perspective effect and throw out a lot of uninteresting details on a picture, a lens should have a focal length at least equal to the greatest dimension of the plate, and a better result is obtained if the focal length exceeds this greatest dimension by from twenty to thirty per cent.

Whenever a short focus lens is used to cover a large plate, it often brings in more details than are wanted, the perspective is painfully violent, objects in the distance appearing much further away than they really are.

All lenses are supplied with a set of diaphragms or stops, which are intended to correct their spherical aberration, and increase their depth of focus, the larger stops being intended for portrait and instantaneous work where it is necessary to sacrifice definition at the edges of the field in order to gain rapidity, the smaller ones used for time exposures and where sharp definition is required to the very edges.

In comparing lenses of the same focal length the one which, with a stop of the same diameter, gives the best definition and shows greater depth of focus, is generally the best, provided it be not defective in some other way.

A first-class rectilinear lens (leaving out wide angle) should, with a stop corresponding to U. S. No. 16, give a *fair* definition

for instantaneous work all over the plate for which it is intended. For time exposures the stop U. S. No. 32 should cover the same plate with a definition, leaving nothing to be desired. Of course exceptions must be made for very large lenses and difficult subjects.

In focussing a given landscape on the ground glass every one has observed that the center of the picture requires a shorter focal length than the sides. This is due to the curvature of the field of the lens; for that reason, when the center of a picture is in exact focus, the sides will not be sharply defined, and *vice versa*. Without the use of a strong eye-piece there appears to be quite a margin or space through which the lens may be moved back and forth without affecting the definition. This space should be utilized in favor of the sides after the center is well defined.

The following is, I believe, a good method: Put in, first, a stop one size larger than the one you know ought to give sharp definition; focus for the central line of distance with focussing screw and for foreground with swing-back. By alternating once or twice in that manner every thing will be sharp on this vertical line. Then bring nearer together ground glass and lens until the definition in the center is just beginning to lose in sharpness; then clamp the camera and put in a smaller stop if a rapid exposure is not wanted.

It may sometimes happen that the swing-back can not be used for focussing purposes, as in the case of an architectural view, or when in the central portion of the view are objects at different distances, requiring different focal lengths, such as a near bridge under which can be seen a distant view. In either case a compromise should be made, treating all principal parts of the picture alike, and then using a very small stop, giving the required definition.

In architectural work and groups greater sharpness is required than for landscapes where those parts of the pictures only which make it interesting need be absolutely sharp.

When small negatives are made, with a view to enlargement or for lantern slides, no pains should be spared to have them as sharp as the lens and subject will permit.

May 20, 1886. L. M. PETITDIDIER.

DEPARTMENT OF ZOOLOGICAL MISCELLANY.

A Call for Contributions.

All members of the Society are earnestly requested to contribute whatever of interest they may have observed or learned concerning quadrupeds, birds, reptiles, fishes, insects, or other animals.

All such articles, of sufficient novelty or importance to be printed, will appear in connection with the name of the author. Many of our members are naturalists; many are hunters, anglers, and sportsmen, and certainly ought to contribute something to these pages, and to the advancement of the Society and the growth of science. Send your articles to Wm. Hubbell Fisher, editor of this department, care of the Cincinnati Society of Natural History, No. 108 Broadway, or to Room 13 Wiggins Block, Cincinnati, O.

Mammals.

We are indebted to Mr. Amos W. Butler, of Brookville, Indiana, for the following items, as to Common Meadow Mouse and Common Mole.

Arvicola riparius—Commom Meadow Mouse.—October 11, 1886, several females were taken in my yard. Of three examined all were far advanced in pregnancy. Two contained six: one, three young. They were found frequenting some sweet potato ridges, near which was a plat of blue grass. Near the latter they were very destructive, but as the distance increased from the unbroken sod their ravages decreased. They worked lengthwise of the ridges, eating many of the potatoes. The largest tubers were selected, and all that was left of some was a thin shell with an opening into the capacious cavity the little rodents had made. It seems probable, considering the condition of the females, that these hollowed-out potatoes may have been intended as resting places.

Scalops aquaticus—Common Mole.—Observed one at work November 9, 1886. The day previous the thermometor registered 18°. November 13, one was observed at work beneath the snow. November 21,one was noticed at work.

Amos W. Butler.

Dr. F. W. Langdon, one of our most faithful and assiduous naturalists, contributes the following as to the Panther and Wolf:

Felix concolor, Linnæus,—PANTHER.—Under date of December 3, 1886, Mr. Raymond W. Smith, of Lebanon, Ohio, writes me as follows: * * * "The Journal of the first Board of Commissioners of Warren county (Ohio), shows that, at their meeting held September 15, 1803, they allowed, among others, the following bill:

"'To Timothy Squires, for killing one panther, 3 dols.' By consulting the deed record of the county for 1803, I find that Squires lived about six miles west of Lebanon, near the Shaker swamps, then very extensive and heavily wooded."

Canis lupus, Linnæus—WOLF.—The above letter also states that "on January 28, 1804, Arnold Snider and Aaron Swill were each allowed two dollars for a wolf-scalp."

F. W. LANGDON, M. D.

ORNITHOLGY.

D. J. H. Hunt, one of our former presidents, contributes the following item respecting the Martin:

CINCINNATI, Nov. 1, 1886.

W. H. Fisher, Dear Sir:—While in Tallahassee, Fla., this summer, I observed something in regard to the habits of the martins that was entirely new to me. I have never seen a martin alight upon a tree with us in the North, but invariably upon houses or the places fitted up for their especial benefit. On the main street of Tallahassee, near the St. James Hotel, was a mulberry tree that had at some time been trimmed in close, so that it had a very compact growth of limbs, forming a dense body of the top of the tree. About 4 o'clock P. M. myriads of martins would congregate there.

It so happened that at this time there was being held an Inter-State Shooting Tournament. Some of the clubs were at the hotel and saw the martins come in every day, and one evening they procured a bag and fitted a hoop in it, and one of the party, secreting himself in the tree, captured the birds in great quantities, just as an entomologist would with his net take butterflies, only that instead of capturing but a single one at a sweep, he would get from ten to twenty birds at a time, which were used next day at the fair ground for practice.

This may not be new to ornithologists, but I send it to you for the benefit, perhaps, of others.

Respectfully, DR. J. H. HUNT.

HERPETOLOGY.

The following items as to black snake, yellow-headed garter snake, pilot snake, ring-necked snake, leather snake, summer green snake, little red snake, Helen's worm snake, cave salamander, common land tortoise, lady turtle, painted turtle, brown swift, triton, are contributed by Amos W. Butler:

Bascanium constrictor, (L.) B. & G. BLACK SNAKE.—On February 10, 1886, when the ground was frozen and snow was to be found in sheltered localities, a black snake which, from the description, was probably this species, was killed near a "sink hole" on the farm of W. S. Case, four miles from Brookville. Later in theseason several other snakes of the same species were killed near the same place.

Eutænia saurita. L. YELLOW-HEADED GARTER SNAKE.—The first specimen of this species from Franklin county was taken April 26, 1886. Several have since been found. This is the most ferocious of all of our snakes. It never waits to be provoked, but hastily coils itself and strikes wickedly at the intruder. I am satisfied that this is frequently thought to be the "copperhead" (*Ancistrodon contortrix*, (L) B. & G.), a snake which is probably extinct in this county.

Coluteer absoletus, Say. PILOT SNAKE; BLUE RACER.—This is the most arboreal of all our snakes. It is frequently found at quite a distance from the ground upon large and small trees alike. A favorite position for repose appears to be upon some drooping or many-branched bush, where it may lie and enjoy the warm sunshine. They are the most destructive to birds of all our snakes. Several instances of their preference for avian food have been noticed the past summer. Some specimens have been brought to me greatly distended by the bird they had just swallowed.

Diodophis punctatus, (L.) B. & G. RING-NECKED SNAKE.—When we found the proper localities, this proved to be a rather common snake. It frequents the dry hillsides where, beneath the bark of long-fallen trees or under a stick or rotten stump, it spends the warmer parts of the day.

Tropidonatus leberis, (L.) Halb. LEATHER SNAKE.—This is regularly the earliest snake to appear in the spring and the last to

disappear in the fall. It was first noted March 22, 1885 and March 20. 1886. Mr. Edw. Hughes reports seeing one apparently very recently killed, Nov. 7, 1886: at that date the ground was frozen, and on the 5th there had been a fall of two inches of snow. This snake appears to be very irregularly distributed. It has been recorded from but two localities in Ohio, and appears to be rare in Indiana outside of the Whitewater valley, where it is common.

Cyclophis æstivus. Linn. SUMMER GREEN SNAKE.—A specimen of this species is in the collection of the Brookville Society of Natural History. It was presented by the late T. B. Ward, of Guilford, Dearborn Co., Indiana, by whom it was taken near that place. It has never been taken in this county, and this is, so far as I know, its first record in southeastern Indiana. It has but one Ohio record.

Tropidoclonium kirtlandi. Kennicott. LITTLE RED SNAKE.—Mr. C. H. Bollman informs me, upon the authority of Dr. D. S. Jordan, that specimens of this species have been taken in Monroe county, Indiana.

Carphophiops helenæ. Kennicott. HELEN'S WORM SNAKE.—Mr. Bollman has taken two specimens of this species in Monroe county.

Spelerpes longicaudus (Green) Bd. CAVE SALAMANDER.—This species, previously known from one locality, has been taken in northeastern part of the county, not far from the Ohio line.

Cistindo Carolina, (Linn.) Cope. COMMON LAND TORTOISE.—In an article on the "Hibernation of the Lower Vertebrates," in the *American Naturalist,* for January, 1885, I gave some notes from observation on this tortoise. They apparently emerge from their winter homes in this latitude late in April, or, in backward springs, early in May. I have noticed them mating as early as May 7th. Mr. E. R. Quick brought me five of six eggs taken July 16, 1886. The following are approximately the measurements in inches and hundredths, of four of them—owing to the fact that they were quite shrivelled when measured, they are not perfectly accurate:

$.95 \times 1.50$; $.85 \times 1.40$; $.85 \times 1.52$; 87×1.55.

These eggs were almost ready to hatch. Usually these tortoises "hole up" by the middle of October at latest, but a friend found one apparently in excellent condition upon the public road November 17, 1886. Prior to this date the thermometer had twice registered as low as 18°.

Crysemys marginata. Agassiz. LADY TURTLE.—Over the most of Indiana this is the prevailing species of painted turtle, but in the Whitewater valley it is rare.

Chrysemys picta. (Herm.) Gray. PAINTED TURTLE.—This is the common species of its genus in southeastern Indiana. The watershed separating Whitewater from the White River and its tributaries marks the boundary, in a general way, between the range of this and the last mentioned species.

Sceloporus undulatus. Harlan. BROWN SWIFT. The distribution of this species in southeastern Indiana is peculiar. It is quite common in Franklin County, but generally, throughout the southeastern quarter of the State, is rare.

Desmognathus ocrophæa. Cope. TRITON. Reported common in Monroe County, Ind., by Mr. Bollman.

AMOS W. BUTLER.

FISHES.

Under this division Mr. Amos W. Butler contributes items respecting the Blind Simon, Zoned Darter, Sand Darter, White Sucker, Red-bellied Dace, Girard, Red-fin, Cope, Black-nosed Dace, Horned Dace, viz.:

Etheostoma variatum. Kirtland. BLIND SIMON. Another specimen of this rare darter was taken by E. R. Quick and the writer, September 23, 1886, in the canal, four miles north of Brookville.

Etheostoma zonale. Cope. ZONED DARTER. A few specimens were taken in the Whitewater River by members of the Indiana Academy of Science, May 21, 1886.

Etheostoma pellucida. Bd. SAND DARTER. Several specimens taken with those of the last-mentioned species.

The following species, taken by Professors W. P. Shannon and O. P. Jenkins, May 22, 1886, in Little Salt and Bull Fork, branches of Salt Creek, a tributary of the west fork of the Whitewater, have not previously been recorded from Franklin County, Indiana:

Catostomus teres. Mitchill. WHITE SUCKER.

Chrosomus erythrogaster. Rafinesque. RED BELLIED DACE. Scarce.

Notropis whipplei. Girard. Common.

Notropis ardens lythrurus. Jordan. RED-FIN. Common.

Notropis atherinoides. Rafinesque. ROSY MINNOW. One specimen.

Ericymba buccata. Cope. Common.

Rhinicchthys atronasus. Mitchill. BLACK-NOSED DACE. Scarce.

Semotilus atromaculatus. Mitchill. HORNED DACE. Scarce.

AMOS W. BUTLER.

BROOKVILLE, IND., *November* 29, 1886.

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H. P. SMITH, J. A. HENSHALL,
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CONTENTS, VOL. XI.

THE JOURNAL
OF THE
Cincinnati Society of Natural History

Vol. XI. CINCINNATI, JANUARY, 1889. No. 4.

PROCEEDINGS.

Business Meeting, *October* 2, 1888.

Vice-President Wm. Hubbell Fisher in the chair.

Minutes of the July business meeting were read and approved.

Minutes of the Executive Board for meetings of July, August and September were read.

Sergt. P. T. Jenkins, U. S. Signal Service, was elected to active membership.

Dr. O. D. Norton was elected Curator of Botany, in place of Prof. Jos. F. James, resigned.

Prof. Thomas Wilson, of the Smithsonian Institution, having applied for the loan of certain pathological specimens of bones, the matter was referred to the Curator of Anthropology, with power to act.

A very interesting collection of Archæological and other specimens, donated by the U. S. National Museum, were exhibited.

Dr. Norton made some remarks on the water-plants in the fountain at Union Square, New York.

Wm. Norris Davis, of Philadelphia, was proposed for Corresponding Membership, by the Executive Board.

Dr. A. J. Howe read a paper, entitled "Depressions in the Earth's Surface," which elicited remarks from Dr. Norton, Mr. Knight and others.

Dr. Norton exhibited a specimen of Spodumene.

Donations were received as follows: From W. W. Dawson, M.D., City, Cocoon of Samia cecropia; from Prof. Jos. F. James, diagram (in frame) of Oxford Gas Well, section of same in glass tube; from L. H. Duwelius, M. D., fossil vertebræ, etc., from "Bad Lands," Dakota; from C. W. Riggs, charred grass cloth.

Adjourned.

SCIENTIFIC MEETING, *November* 4, 1888.

President Skinner in the chair. Nine members present, but several more came in afterward.

Minutes of September Scientific Meeting read and approved.

It being the night of the election of the President of the United States, and a great deal of noise and confusion being in the streets, the reading of Col. Abert's paper was postponed for one week.

A letter from Mr. W. T. Garratt in relation to the donation of specimens of minerals from the California State Mining Bureau, and enclosing a receipted bill for freight on same, was read by President Skinner.

On motion the Executive Board was instructed to remit the amount of the freight bill to Mr. Garratt.

A vote of thanks was extended to Mr Garratt, for his praiseworthy efforts in obtaining this fine collection for the Society,

The following gentlemen were proposed for active membership: Dr. Ralph S. Michel, J. M. Newton, Dr. B. F. Beebe, Dr. Edwin Ricketts.

Wm. Norris Davis was elected to Corresponding Membership.

Mr. D. L. James read a letter from Dr. N. L. Britton, Secretary of the Audubon Monument Committee, acknowledging the receipt of $6.50 from members of the Society.

Donations were received as follows: From James A. Henshall, M.D., 75 species of Ohio fishes, represented by numerous specimens, collected and prepared for exhibition by the donor. From U. S. Fish Commission, through Capt. J. W. Collins, specimens of fishes, mackerel food, foraminifera, and salmon eggs and fry; from G. D. Gifford, New Bedford, Mass., specimen of spider crab; from Florence Ware, City, specimen Conus tessellatus.

Adjourn d.

SPECIAL MEETING, *November* 11, 1888.

President Skinner in the chair.

This meeting was for the hearing of the paper on "Guns, and the Measurement of the Velocity of Projectiles," by Col. J. W. Abert, postponed from the regular November meeting. The paper, by the request of Col. Abert, was read by President Skinner.

Capt. A. H. Russell, U. S. A., in charge of the Army Department of the Government Exhibit at the Centennial Exposition, then gave a practical demonstration of the measurement of the velocity

of a bullet, by means of the Boullenge Chronograph; and explained the operation of the pendulum chronograph.

The lecture-room of the Society was well filled by an appreciative audience.

Adjourned.

SCIENTIFIC MEETING, *December* 4, 1888.

President Skinner in the chair.

The lecture-room of the Society was well filled.

Minutes of the November Scientific and the special meetings were read and approved.

Capt. A. H. Russell, U. S. A., gave a very interesting practical lecture on "How Bullets Fly Through the Air," explaining the mechanics and science of projectiles by the use of a number of ingenious contrivances and apparatus.

Dr. A. J. Howe read a paper entitled "The Riverside Skull;" being a few remarks in relation to the skull recently found at Riverside, and an extended dissertation on crania.

Col. J. W. Abert then supplemented Capt. Russell's remarks by giving a few striking and familiar examples of the principles of the flight of an elongated bullet from a rifled gun.

Mr. Davis L. James read by title two papers, one on "The Distribution of *Vernonia*," by Prof. Jos. F. James, and the other a "Monograph of the *Phalloidea*," by A. P. Morgan.

Upon motion a vote of thanks was extended to Capt. Russell and Dr. Howe for their able and pleasing efforts.

President Skinner gave an interesting account of a new plan or process for the reduction of refractory gold and silver ores, the discovery of Mr. Wm. Norris Davis, of Philadelphia.

Mr. Davis L. James reported progress on behalf of the Lecture Committee, and stated that the programme of lectures would soon be announced; that most of the lecturers had been secured; and that Greenwood Hall, by the courtesy of the Ohio Mechanics Institute, had been obtained for these lectures.

Dr. B. M. Ricketts suggested that a committee be appointed to endeavor to secure a suitable lot in Eden Park, with a view to the erection, at some future time, of a building for the Society.

Upon motion Dr. Ricketts was appointed a committee to present names for such a committee at the next meeting of the Society.

The following names were proposed for active membership: John E. Bell, Alfred Warren and Dr. J. S. Newberg.

The following gentlemen were elected to active membership: J. M. Newton, Dr. Ralph S. Michel, Dr. B. F. Beebe, and Dr. Edwin Ricketts.

It being suggested that as the January meeting would occur on New Year's night, it would be desirable to postpone it, it was upon motion resolved that the January meeting be held on the second Tuesday of the month.

Upon motion of Prof. Harper the resignation of Rev. Raphael Benjamin, as a member of the Society, be accepted with regret, and that this feeling of the Society be communicated to Mr. Benjamin by the Secretary.

President Skinner gave notice that at the next regular meeting of the Society a member of the Executive Board would be elected in place of Mr. Benjamin, removed to New York.

Donations were received as follows: From Robt. Clarke, Esq., City, casts of Cincinnati and Waverly tablets; from California State Mining Bureau, through W. T. Garratt, Esq., large collection of minerals, woods, fossils, casts, etc.; from Dr. Kusnick, Riverside, prehistoric skull (human), portion of mastodon tusk; from Dr. Tarleton H. Bean, of U. S. Fish Commission, specimen of White-winged Scoter; from Mr. Powell, of Powell & Clement, specimen of truffle(?).

Adjourned.

REPORT ON THE MUSEUM.

BY H. P. SMITH, CUSTODIAN.

CINCINNATI SOCIETY OF NATURAL HISTORY—*Dec.* 15, 1888.

In conformity with instructions to that effect from the Executive Board of the Society, I have the honor to report as follows upon the extent of the collections of the Society in the several departments, also upon the library and the exchange of publications.

I. PALÆONTOLOGY.

I.	The Trenton and Hudson River Groups are represented in the Society's collection by	70	species.
II.	The Cincinnati Group "	317	"
III.	" Clinton " "	16	"
IV.	" Niagara " "	120	"
V.	" Medina and Helderberg Group, by	100	"
VI.	" Corniferous " "	100	"
VII.	" Carboniferous " "	225	"
VIII.	" Sub-Carboniferous " "	200	"
IX.	" Cretaceous " "	75	"
X.	" Triassic " "	5	"
XI.	" Tertiary " "	175	"
XII.	" Quaternary " "	32	"
XIII.	" European Formations " "	130	"
	Total	1,619	"

Of this number more than 600 species are stored in drawers.

CINCINNATI GROUP IN DETAIL.

The number of genera and species given is based upon the "Catalogue of the Fossils of the Cincinnati Group," by Prof. Jos. F. James.

The first line of numbers under "Genera" and "Species," indicates the number of genera or species in the Catalogue and the second line the number in the collection of the Society.

Class.	*Genera.*	*Species.*
Plantæ	21—17	37—27
Spongida	12— 1	29— 5

Class.	*Genera.*	*Species.*
Polypi	26—14	132—86
Crinoidea	6— 4	42—16
Cystoidea	6— 4	19—11
Asteroidea	3— 1	17— 2
Ophiuroidea	2— 1	3— 1
Polyzoa	9— 6	63—34
Brachiopoda	15—13	117—71
Gasteropoda	15—12	65—25
Pteropoda	2— 1	4— 2
Cephalopoda	8— 4	40—19
Lamellibranchs	18—12	89—33
Annelida	12— 8	33—11
Crustacea	13—10	54—20
Pisces(?)	2— 0	3— 0
Incertas edes	10— 5	19— 8
Totals,	180—113	768—371

REMARKS ON DEPARTMENT OF PALÆONTOLOGY.

Though the collection may not be called large it is in excellent condition and contains many rare and very valuable specimens.

The horn cores of *Bison latifrons*, and the cranium of *Bootherium Cavifrons*, which are in almost perfect state of preservation, are of great value and would be the pride of any museum in the world.

The gaps which exist in the local collection, may, I believe, be filled by members and friends of the Society, if they be informed of what is lacking, and solicited, on behalf of the Society, to fill such of these wants as they may feel able to do.

This department should above all others be complete in its local collection. In this city, situated in what is known in this country and Europe as the classical ground of the Lower Silurian, there certainly should be a complete collection of its fossils, and under every consideration this Society should possess it.

II. BOTANY.

There are in the herbarium of this Society about 3,500 species of plants represented. This number does not include the Morgan Collection of Fungi, of which mention will be made later. The flora of California and Mexico is well represented; largely in collections from these localities purchased from C. G. Pringle.

The local flora, exclusive of Fungi, as catalogued by Prof. Jos. F. James, includes approximately 899 species.

There are in the herbarium of the Society 745 species, collected in this immediate vicinity or in Ohio, which latter may be counted as belonging to our local flora. This number does not include specimens from Indiana and Kentucky, many of which are also found in the vicinity of Cincinnati.

The collection of Fungi includes a large number of species from Hamilton County. Almost the entire collection is from the herbariums of Mr. A. P. Morgan and Prof. Jos. F. James.

III. CONCHOLOGY.

There are in the collection of this Society more than 3,200 species of shells, named and localized.

No complete catalogue of the shells of this locality has been prepared, so it is impossible to give with exactness the local value of the collection.

The Society possesses a fine collection of Unionidæ from this vicinity, and a good collection of the Helicidæ, so without definite numbers, it may be said that the local collection of shells is probably as good as in any other department of the Museum.

IV. ICTHYOLOGY.

The department of Icthyology contains at this time 264 species of fish.

Of these, 150 are marine, received from the U. S. Fish Commission. Of the fishes of this locality, the Society has, up to this time, had but four representatives.

During the past summer Dr. Henshall has collected fishes of the Ohio and tributaries for the Society, in number, about 110 species, so the collection now possesses nearly two-thirds of the fishes of the State. These fishes have been identified, labeled and placed in the collection by the individual work of Dr. Henshall.

V. HERPETOLOGY.

This department contains 28 species and 32 specimens.

It is very incomplete in the local reptilian fauna.

VI. ORNITHOLOGY.

The department of Ornithology contains a few very fine exotics, and is well supplied with local species.

The list of Dr. F. W. Langdon gives 279 species of birds found in Cincinnati and vicinity. Of these the Society has, of mounted specimens, 133 species, of skins 90 species, a total of 223 species. Among the skins should be mentioned that of the Cincinnati Warbler, taken and named by Dr. Langdon; the only specimen ever taken. The local collection is being filled as rapidly as possible. The collection needs more room and better light to display it properly and give it its true value.

VII. MAMMALOLOGY.

The Society possesses an excellent and very valuable collection of mammalian fauna, though it is not a representative local collection, having very few of the mammals of this vicinity.

The several classes of mammalia are represented as follows:

Primates,	24	Species,	37	Specimens.
Carnivora,	22	"	42	"
Pinnipedia,	2	"	2	"
Ungulata,	6	"	6	"
Cheiroptera,	2	"	5	"
Insectivora,	2	"	2	"
Rodentia,	14	"	15	"
Edentata,	1	"	1	"
Marsupialia,	6	"	9	"
Totals,	79	"	119	"

VIII. ENTOMOLOGY.

A large proportion of the specimens in the department of Entomology are found in this locality, but it is far from being complete in this respect.

There are more than 450 species of Coleoptera in the collection.

Of Lepidoptera there are not so many species represented; though I am unable at present to state the exact number—200 species would be somewhat less than the actual number.

The other classes are represented by a small number of specimens.

The collection needs more commodious and convenient quarters than it is possible for it to have at present.

IX. OSTEOLOGY.

The Society possesses a number of very good skeletons, one, that of the giraffe, being quite a rare one.

The finest skeleton possessed by the Society, that of the elephant, can not be set up for want of room, and in consequence has to be stored in the basement.

The collection contains, besides the two mentioned above, fair skeletons of the camel, moose, deer, kangaroo, wombat, lion, alligator and several more common animals, and a few birds and reptiles. There is an abundance of material in this department to make a very creditable exhibit.

X. ETHNOLOGY.

In this department the Society has a series of casts of skulls representing types of different nationalities, and several recent skulls of Indians; together with implements of war and domestic use, from the Indians, Swiss Lake Dwellers, Cliff Dwellers, etc.

The archæological collection is very valuable; containing a large number of skulls and relics from the pre-historic cemetery at Madisonville, Ohio, a collection which it would be impossible to duplicate. A collection of pottery from Missouri, of considerable value, and specimens lately received from the National Museum and the California State Mining Bureau, complete the report of this department.

It will be seen that local archæology is well represented here, in the Madisonville collection, but this is a small part of the rich harvest which this part of the country has afforded—too much of which has been compelled to go, or permitted to go, to Eastern museums for a home.

XI. MINERALOGY.

The collection of minerals contains about 1,200 specimens, and is in excellent condition as to identification and locality.

A collection of about 80 specimens, received from the California State Mining Bureau, has recently been added.

THE LIBRARY.

The library of the Society now includes about 4,500 books and pamphlets, and its increase is steady and rapid.

Its principal source of increase is the exchange of the JOURNAL for the publications of scientific societies, and for scientific periodicals in all parts of the world.

The accompanying list of these exchanges will show the extent and great value of this work.

In no other department is the want of sufficient room so much felt as in this.

New and valuable exchanges are frequently added to the list: among those of the present year are the Bristol Naturalists' Society of England, and the Survey of India Department.

List of exehanges received for the JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

I. UNITED STATES.

Albany:

Albany Institute.

New York Agricultural Exp. Station.

New York State Museum.

Amherst:

Amherst College.

Baltimore:

Johns Hopkins University.

Boston:

American Academy of Arts and Sciences.

Boston Society of Natural History.

Brooklyn:

Entomological Society.

Brookville, Ind.:

Natural History Society.

Amos W. Butler.

Buffalo:

Society of Microscopists.

Society of Natural History.

Cambridge:

Museum of Comparative Zoology.

Peabody Museum of Archæology and Ethnology.

Psyche.

Chapel Hill, N. C.:

Elisha Mitchell Scientific Society.

Chicago:

Academy of Sciences.

Cincinnati:

Ohio Historical and Philosophical Society.

Cincinnati Observatory.

Public Library.

Columbia, Mo.:
University of Missouri.
Champaign, Ill.:
Illinois State Laboratory of Natural History.
Columbus:
State Meteorological Bureau.
Horticultural Society.
Crawfordsville, Ind.:
Botanical Gazette.
Davenport, Iowa:
Academy of Natural Sciences.
Denver:
Colorado Scientific Society.
Des Moines:
Academy of Sciences.
Frankfort:
Kentucky Geological Survey.
Manhattan, Kan.:
Journal of Mycology.
Mendon, Ill.:
American Antiquarian.
Milwaukee:
Public Museum.
Minneapolis:
Minnesota Academy of Sciences.
State Geologist.
Newport, R. I.:
Natural History Society.
New Haven:
American Journal of Science.
Connecticut Academy of Arts and Sciences.
New Orleans:
Academy of Sciences.
New York:
American Museum of Natural History.
American Geographical Society.
American Garden.
The Auk.
Linnean Society.
New York Academy of Sciences.

New York Microscopical Society.
School of Mines Quarterly.
Torrey Botanical Club.

Philadelphia:
American Naturalist.
American Philosophical Society.
Franklin Institute.
Philadelphia Academy of Natural Sciences.
Philadelphia Zoological Society.
Second Geological Survey of Pennsylvania.
Wagner Free Institute.

Poughkeepsie:
Vasser Brothers Institute.

Princeton:
Princeton College.

Salem:
Essex Institute.
American Association for the Advancement of Science.

San Francisco:
California Academy of Science.
California State Mining Bureau.
Technical Society of the Pacific Coast.

Sedalia, Mo.:
Natural History Society.

St. Louis:
Academy of Natural Sciences.

Topeka:
Kansas Historical Society.
Washburn College Laboratory of Natural History.

Trenton, N. J.:
Natural History Society.

Washington:
American Monthly Microscopical Journal.
Bureau of Education.
Entomological Society.
Philosophical Society.
Smithsonian Institution.
U. S. Geological Survey.
U. S. National Museum.

U. S. Department of Agriculture.
U. S. Commission of Fish and Fisheries.

Number of Exchanges in the United States, 74.

II. Foreign.

Argentine Republic:
Cordoba: Academia Nacional de Ciencias.

Austria:
Vienna: K. K. Naturhistorischen Hofmuseum.
Kaiser Konig Geologischen Reichsanstalt.
Gorz: Baron von Thumen.

Australia:
Sidney: Linnean Society.
Department of Mines, N. S. Wales.
Royal Society of New South Wales.
Melbourne: Public Library, Museum and National Gallery of Victoria.

Belgium:
Brussels: Societe Malacologique de Belgique.

Brazil:
Rio Janeiro: Museu Nacional.

Canada:
London: Canadian Entomologist.
Montreal: Canadian Record of Science.
Toronto: Canadian Institute.
Ottawa: Geological and Natural History Survey of Canada.
Field Naturalists' Club.
Winnipeg: Manitoba Historical and Scientific Society.

Chili:
Santiago: Wissenschaftlichen Verein.

Costa Rica:
San Jose: Museu Nacional.

England:
Bristol: Naturalists' Society.
London: Royal Microscopical Society.
Manchester: Philosophical Society.

France:
Toulouse: Academie des Sciences, Inscriptions et Belles Lettres.

Germany:
Augsburg: Naturhistorischen Verein.

Berlin: Akademie die Wissenschaft.
Botanischen Verein der Prov. Brandenburg.
Basel: Naturforschenden Gesellschaft.
Bremen: Naturwissenschftlichen Verein.
Braunschweig: Verein fur Naturwissenschaft.
Cassel: Verein fur Naturkunde.
Frankfort on Oder: Societatum Litterae.
Giesen: Oberhessiche Gesellschaft fur Natur und Heilkunde.
Halle: K. Leopold-Carolin Deutschen Akademie der Naturforschen.
Leipsic: Verein fur Erdkunde.
Munster: Westfalichen Provinzial Verein fur Wissenschaft und Kunst.
Stuttgart: Verein fur Vaterlandische Naturkunde in Wurttemberg.

Holland:
Leiden: Netherland Zoological Society.

India:
Calcutta: Geological Survey of India.
Survey of India Department.

Italy:
Naples: Societe Africana d Italia.
Pisa: Societa Toscana di Scienza Naturali.
Rome: Ministero di Agricoltura Industria E Commercio.
Turin: Musei di Zoologia ed Anatomia Comparata.

Japan:
Tokyo: Deutschen Gesellschaft fur Natur und Volkerkunde Ostasiens, Teikoku Daigakee.

Mexico:
Mexico: Sociedad Mexicana de Historia Natural.
Sociedad Cientifica, "Antonio Alzate."

Norway:
Christiania: Royal University of Norway.

Nova Scotia:
Halifax: Nova Scotian Institute of Natural Sciences.

Russia:
Kiew: Societe des Naturalistes.
Moscow: Societe Imperiale des Naturalistes.
St. Petersburg: Comite Geologique de Russie.

Scotland:

Edinburgh: Botanical Society.
Royal Society.
Royal Physical Society.

Glasgow: Natural History Society.

South Africa:

Cape Town: Philosophical Society.

Spain:

Barcelona: Academia de Ciencias Naturales y Artes.

Sweden:

Stockholm: l'Academie Royale des Sciences.
Kong'l vetenkaps Akademiens.
L'Institute Royal Geologique de la Suede.
Riksmusei Palaentologiska.

Switzerland:

Bern: Naturforschende Gesellschaft.

Zurich: Schweirzerischen Naturforschende Gesellschaft.

Total Foreign Exchanges, ...	64
Domestic Exchanges, ...	74
Grand Total, ...	138

Respectfully submitted,

HORACE P. SMITH, Custodian.

CONTRIBUTIONS TO THE ICHTHYOLOGY OF OHIO.
No. 2.

By Dr. James A. Henshall.

In the Journal of the Society for July-October, 1888, pp. 76-80 I have recorded a list of seventy species of fourteen families of fishes collected within the limits of Hamilton County, in April and May, 1888. Since that time, in July, I visited Sandusky and Put-in-Bay, where I was enabled to identify a number of species belonging to the fauna of Lake Erie.

In August, Hon. Nicholas Longworth of this city, in the cause of science, kindly placed at my service his fine and commodious steam-yacht "C. O.," with full crew of six men, for the purpose of an exploration of the Ohio River and its tributaries. Owing to this characteristic act of liberality and generosity on the part of Judge Longworth, Prof. C. H. Gilbert and myself were enabled to spend three weeks on the Ohio and its tributaries, between Marietta and Cincinnati; and although the river was at an unprecedented high stage of water for the season—from twenty to thirty feet above low water-mark—covering the bars and backing up the tributaries for miles, we succeeded in collecting most of the species named in my former list, in extending the range of other species, and in adding some not named in that list, and others not heretofore taken in Ohio waters.

During September and October I assisted Capt. J. W. Collins and Dr. T. H. Bean, of the U. S. Fish Commission, in collecting fishes from Ross Lake, Little Miami River and Sycamore Creek, for stocking the aquaria of the Commission on exhibit at the Ohio Valley Centennial Exposition, and I also had opportunities of examining the aquaria of Mr. Hugo Mulertt at the same Exposition. I have also occasionally inspected the fish markets of Cincinnati for species from the Ohio River and Lake Erie.

From these various sources I have been enabled to add forty species and ten families of Ohio fishes not named in my first list—a few of which are also to be added to the fauna of Hamilton County.

My former list and the present one aggregate one hunderd and ten species, distributed among twenty-four families, which I think is fully two-thirds of the entire number of known species to be found in Ohio waters. Next summer I hope to add to these lists by exploring the streams in the interior of the State, on both sides of the water-shed separating the waters of Lake Erie from those of the Ohio Valley.

A number of fishes which I know to be common to Lake Erie, and some that belong to the Ohio River system, are not included in these lists, and will not be until I have positively identified them as existing within the limits of the State.

I am arranging a series of species from these collections for the Museum of the Society, and shall add to it from time to time as opportunity offers; for I deem it of the utmost importance that the Society should possess as complete an exhibition of the fishes of Ohio waters as possible. Heretofore this branch of the fauna of the State of Ohio has been entirely ignored or neglected, for I find, outside of my own collections, but four specimens of Ohio fishes in the Museum of the Society—a sturgeon, a paddle-fish, a gar and an eel.

In the following list the name of the original describer of each species is alone given, as in the first list. Where the original combination of generic and specific title is still retained, the name of the author is printed without parentheses; where, however, the original describer places the species in question in a genus different from the one here adopted, the author's name is inclosed in parentheses—following the plan adopted by Dr. D. S. Jordan in his last edition of "Manual of the Vertebrates."

Those families marked with an (*) asterisk are additional to the first list.

Family I.—PETROMYZONTIDÆ. *

1. PETROMYZON CONCOLOR (Kirtland). Lamprey. A specimen of this species, about six inches long, was presented by Dr. Chas. E Caldwell, it having passed through a hydrant pipe in a house in the city.

Family II.—LEPISOSTEIDÆ. *

2. LEPISOSTEUS OSSEUS (Linnæus). Long-nosed Gar. Ohio River; Lake Erie.

3. LEPISOSTEUS PLATYSTOMUS Rafinesque. Short-nosed Gar. Lake Erie.

Family III.—AMIIDÆ. *

4. AMIA CALVA Linnæus. Dog-fish. Lake Erie.

Family IV.—SILURIDÆ.

5. AMEIURUS NATALIS (LeSueur). Yellow Cat. Lake Erie.

6. AMEIURUS VULGARIS (Thompson). Long-jawed Cat. Lake Erie.

7. AMEIURUS NEBULOSUS (LeSueur). Bull-head. Lake Erie.

8. LEPTOPS OLIVARIS (Rafinesque). Mud Cat. White Oak Creek; Ohio River.

9. NOIURUS MIURUS Jordan. Variegated Stone Cat. Ohio River (Raccoon Island).

10. NOTURUS GYRINUS (Mitchill). Chubby Stone Cat. Ross Lake.

Family V.—CATOSTOMIDÆ.

11. ICTIOBUS URUS (Agassiz). Razor-backed Buffalo. Ohio River (Cincinnati).

12. ICTIOBUS THOMPSONI (Agassiz). Lake Carp. Lake Erie.

13. CATOSTOMUS CATOSTOMUS (Forster). Northern Sucker. Lake Erie.

14. MOXOSTOMA AUREOLUM (LeSueur). Lake Red-horse. Lake Erie.

The species in first list called MOXOSTOMA CRASSILABRE has since proved to be PLACOPHARYNX CARINATUS, which we found to be abundant in the Ohio and its tributaries. I do not think the former species exists west of the mountains.

Family VI.—CYPRINIDÆ.

15. HYBOGNATHUS NUCHALIS Agassiz. Silvery Minnow. White Oak Creek; Ohio River.

16. HYBOPSIS HYOSTOMUS (Gilbert). Hog-mouthed Chub. Ohio River (Raccoon Island).

17. CYPRINUS CARPIO Linnæus. German Carp. I saw two fine Mirror Carp taken on a trot line, with helgramite (larva of CORYDALIS CORNUTUS) bait, at Remington, L. Miami River; Ross Lake.

Family VII.—SALMONIDÆ *

18. COREGONUS CLUPEIFORMIS (Mitchill). White fish. Lake Erie.

19. COREGONUS ARTEDI LeSueur. Lake Herring. Lake Erie.

20. Salvelinus namaycush (Walbaum). Lake Trout. Lake Erie.

21. Salvelinus fontinalis (Mitchill). Brook Trout. Castalia Creek (near Sandusky). This is a very cold spring creek proceeding from the well-known Castalia spring, and is, I believe, the only trout stream in Ohio; the stock is kept up by the introduction of fry at regular periods.

Family VIII.—Esocidæ *

22. Esox vermiculatus LeSueur. Grass Pickerel. Maumee River; Lake Erie.

23. Esox lucius Linnæus. Northern Pickerel; Pike. Lake Erie; Sandusky River.

24. Esox nobilior Thompson. Mascalonge. Ohio River; Lake Erie. I have seen heads of large pike from several streams in eastern Ohio and North-western Kentucky, said to have weighed from thirty to forty pounds, and there were no specific differences between them and those of the mascalonge of the Great Lakes.

Family IX.—Anguillidæ *

25 Anguilla anguilla (Linnæus). Eel. Lake Erie; Ohio River.

Family X.—Gasterosteidæ. *

26. Eucalia inconstans (Kirtland). Brook Stickleback. Castalia Creek.

Family XI.—Aphredoderidæ. *

27. Aphredoderus sayanus (Gilliams). Pirate Perch. Lake Erie.

Family XII.—Centrarchidæ.

28. Pomoxis annularis Rafinesque. New-light; Croppie. Muskingum River; Ohio River (Raccoon Island).

29. Ambloplites rupestris (Rafinesque). Rock Bass. Lake Erie; Ohio River (near L. Sandy R.).

30. Lepomis notatus (Agassiz). Sun-fish. L. Miami River.

31. Lepomis gibbosus (Linnæus). Common Sun-fish. Ross Lake; Lake Erie.

Family XIII.—Percidæ.

32. Etheostoma asprellus (Jordan). Rough Darter. Muskingum River.

33. ETHEOSTOMA COPELANDI (Jordan). Copeland's Darter. Muskingum River; Ohio River (Raccoon Island).

34. ETHEOSTOMA SHUMARDI (Girard). Shumard's Darter. Muskingum R.; Ohio R. (near Parkersburg).

35. ETHEOSTOMA SCIERUM (Swain). Shaded Darter. Ohio River (near L. Sandy R.).

36. ETHEOSTOMA EVIDES (Jordan and Copeland). Gilded Darter. Ohio R. (Raccoon Island).

37. ETHEOSTOMA CAMURUM (Cope). Blue-breasted Darter. Muskingum River.

38. PERCA FLAVESCENS (Mitchill). Yellow Perch. Lake Erie; St. Mary's Reservoir.

Family XIV.—SERRANIDÆ, *

39. ROCCUS CHRYSOPS (Rafinesque). White Bass. Lake Erie.

Family XV.—GADIDÆ *

40. LOTA LOTA (Linnæus). Lake Erie.

BIG GUNS.

By Col. J. W. Abert.

(Read November. 1888.)

The advances in artillery since our late war have placed gunnery among the most refined mechanical sciences of the age.

In 1842 experiments were made by Col. Bomford U. S. A., which showed the diminishing pressure of a charge of powder from the breech to the muzzle of a cannon. These experiments controlled the external form of the gun. And the tensile strength of a square inch bar, of the metal of which the gun was composed, showed its strength, and limited the quantity of powder in the charge.

When we consider that 200 pounds to the square inch is the limit of the test of our steamboat boilers, and that some of our steel guns are made of metal which possessed a tensile strength of 33 tons to the square inch, we can appreciate the stupendious power of the machines which the progress in the art of war has placed in our hands in the rifled cannon of the present times.

It is an axiom in artillery that no gun can sustain a pressure per square inch greater than the tensile strength of a square inch bar of metal of which it is composed.

The amount of pressure exercised by the firing of the charge of powder can be shown for every part of the gun, from breech to muzzle—

First, by Bomford and Wade's experiments.

Second, by Rodman's pressure guage.

Third, by the Electro-ballistic Chronoscope.—

To Prof. Joseph Henry, of the Smithsonion Institution, and formerly my old Professor at Princeton College, N. J., belongs the credit of using the electric spark in recording the velocity of projectiles, and solving the most difficult of problems in gunnery. Thus, we obtain the initial velocity; also the velocity of the projectiles at any point of the trajectory.

Prof. Henry devised the first complete Electro-ballistic Chronoscope, for recording by electrical agency the time occupied by a

projectile in its passage between two given points. Henry's chronograph provides against every instrumental error. Terminal pairs of wires from a number of different pairs of screens, through which the projectile passed, would send sparks which perforated the graduated paper covering the recording cylinder, and impressed their marks; thus, the velocity of the projectile, in all required points in its path, may be determined by a single experiment. He visited Maj. Mordecai during his ballistic experiments at the Washington Arsenal and told him that velocities could be best determined by electricity.

Capt. Schultz of the French army combined a method of graphically recording vibrations of a tuning-fork with Helmholtz's way of making them isochronous and Henry's cylinder and induction spark, and produced an apparatus capable of meeting every demand required in the solutions of questions in regard to this subject —

Proof of gunpowder,
Hygrometrical test,
Proportion of ingredients,
Mode of manufacture,
Density,
Size of grains,
Charges for guns,
Cartridges for cannon,
Windings of balls,
Loss of force by the vent,
Effects of wads, etc.

In a X inch gun, 100 inches in length, the total time required for the projectile to reach the muzzle is $\frac{1}{100}$ of a second. Records are obtained from the chronoscope of the time required for the passage of the shot, between two points in the gun only 2.7 inches apart.

If you desire to estimate the strain on the gun, or the quantity of motion imparted to a projectile, we know that if the mean pressure (P) of the gas be multiplied by the space (S) passed over by the projectile in acquiring its velocity, the result will be the measure of the work done by the charge of powder; and it will be equal to the work of stopping the same projectile, no matter how or by what means it may be done.

The same result is obtained by measuring the velocity imparted to the projectile under the circumstances mentioned, and mul-

tiplying the square of the velocity by one-half the mass of the projectile, since the mass is equal to the weight divided by the force of gravity.

"The expression of the work stored in the projectile, and which must be expended in bringing it to rest$=\frac{W v^2}{2 g}$ where W.=weight of the projectile, V.=velocity of the projectile in feet, and g= the force of gravity in feet, or the velocity a body will acquire by its own weight in one second of time."

The machines for ascertaining pressure are: The ballistic pendulum, Navez's Chronoscope, Benton's thread velocimeter, Boulenges' Chronograph, Schultz's Chronoscope, Rodman's pressure guage, Noble's Chronoscope and Vignotti, Cushing and others. Through the kindness of Capt. A. H. Russell, U. S. ordinance corps, we have the opportunity of examining the chronoscopes which were displayed at the War Department Exhibit at the Cincinnati Exposition. Capt. Russell will demonstrate the practical working of these machines.

The purpose of these machines is to measure the velocity of a bullet or a cannon ball, while passing over the space between two targets.

Whether we use pendulums, or heavy rods, as in the Boulange machines, the general principles are the same. I have made a drawing on the blackboard of the Boulange machine, as it seemed to me to be the simplest to understand.

This instrument consists of a central standard or supporting rod which carries two electro-magnets. The magnet highest upon the Standard is connected by electric wires to target No. 1, and it supports a heavy rod of 20 inches in length, which rod drops the instant that target No. 1 is attained by the projectile. When target No. 2 is ruptured the magnetic current to the second magnet is cut, and instantly the second rod falls. In falling it strikes the disk at the end of a lever, which sets free a circular knife. This knife makes a cut on the first rod, which thus records how far the first rod had fallen before the second rod was set free.

Before beginning to experiment, you set free the short rod only, and the cut or nick made by the knife when the long or chronometer rod is at rest, will give the "origin" or zero point from which you measure the height fallen by the chronometer rod, while the projectile is traversing the distance between the targets.

Since the fall of the chronometer rod follows the law of fall of heavy bodies, we have the formula $T' = \sqrt{\frac{2H}{g}}$, which is the equation of this machine. Now T′ represents the time which the chronometer rod occupies in falling (the distance H), supposing every part of the machine to act instantaneously, but there is a delay in the action of the first magnet, which would shorten the value of the time, we therefore designate it by — M.

There is a delay in the action of the second magnet, which upholds the short or "register rod," designate this by + M′; a delay due to the time required by the short rod to fall on the trigger, call this + t′; next we have a delay caused by the time required for the disengagement of the trigger, equal to + t″; and lastly a a delay required for the knife to reach the chronometer rod, call this correction + t‴, consequently we must correct the value of T′ by subtracting the sum of these quantities. Designating the true time by T, we now find that $T = T' - (M' + t' + t'' + t''' - M)$ or calling the sum of the corrections t we have $T = T' - t$.

The value of (t) the sum of the corrections can be obtained by means of the device called the "Disjunctor;" it serves to break the electric currents from both targets at the same instant, and the nick made by the knife on the chronometer rod will mark a point called the "disjunctor reading." Commencing with this point as the origin, or O point, we get the corrected value T′ - t, that is the true value T.

A graduated rule, or scale, is used for measuring the height of the nick above the zero point. If you have the scale calculated for a distance of fifty yards, the velocity of the projectile can be at once determined. Should it be necessary to place the targets nearer, the velocity can be found by multiplying the number read off the scale by the actual distance between the targets divided by fifty. The height of the nick on the chronometer rod above the "origin" is given by the formula $H = \frac{1}{2} g T'^2$.

In the chronoscopes which have pendulums in place of the rods, the time due to the arc of oscillation can by the theory of the pendulum be readily ascertained.

Benton's chronoscope recommends itself on account of its great simplicity, as it dispenses with the necessity of voltaic batteries. It operates by the means of threads which are stretched from the targets to the pendulums, the threads in being ruptured by the pro-

jectile, on traversing targets 1 and 2, instantly let fall the pendulums corresponding to these targets.

The Noble chronoscope registers the precise instant when a projectile passes certain points in the bore of the gun. The recording apparatus consists of disks 36 inches in circumference, which are made to revolve at the speed of 1,000 inches per second, linear velocity: by means of a vernier each inch is divided into $\frac{1}{1000}$, a linear representation is thus obtained at the circumference, of the one millionth part of a second ($\frac{1}{1000000}$ of a second).

Plugs of steel containing the wires of the induction coil, are screwed into the gun, with a device at the end of the plug, so that as each plug is reached by the projectile, the wires are cut and the spark is delivered.

Records have been obtained of plugs only 2.4 inches apart.

From the velocities of the projectile thus obtained we can determine exactly the amount of pressure on each square inch of the bore, due to the firing of the charge of powder, and the velocity at any point of the trajectory.

The total energy of a body in motion is the whole amount of work it will produce before being brought to a state of rest, it varies as the weight of the body multiplied by the square of the velocity. This work is equal to the weight it is capable of raising one foot high, and is equal to the weight in pounds of a projectile, multiplied by the square of the velocity in feet and divided by twice the accelerating force of gravity.

Thus, if a projectile of 165 pounds, be moving with a velocity of 1,470 feet per second, the work it will accomplish is

$$\frac{165 \times (1470)^2}{64.4} = 2472 \text{ foot tons.}$$

The energy in the 2,000 pound projectile fired from the 100 ton gun at Spezia was over 30,000 foot-tons. That is to say, that if the Italian armor-clad vessel, the "Duilio" weighed 10,000 tons, the energy stored in the projectile of one of her own guns would lift the whole ship bodily to the height of three feet.

If the projectile should strike the turret of a monitor, which turret weighed 400 tons or so, the gearing would be so strained that the turret could not work; or when we consider there is sufficient energy to lift it as high as the main-top, it requires no great stretch of the imagination to understand that such a turret, with all its contents might be knocked clean overboard.

The penetrating effect of a projectile is equal to the energy per inch of circumference in foot-tons, *i.e.*, the total energy divided by the number of inches in the circumference of the projectile—

$$P = \frac{Wv^2}{2g \times 2\pi R^2}$$

The energy of the projectile is met by the resistance required to shear a hole in the armor, which will coincide with the circumference of the projectile.

In 1865 our largest guns were smooth-bore, muzzle-loaders, 20 feet 3 inches long, 20 inches caliber, and weighed 51 tons.

Then came the long, tapering steel guns, built up of numerous coils of steel, with breech plugs or "obturators," which are hinged to the breech of the gun, or are arranged to rest on a sliding table, to be moved by steam.

The dimensions of the steel guns are as follows:

23 feet	4	inches	long,	8 inch	caliber,	13 tons	weight.
28 "	5	"	"	10	"	27 "	"
34 "	1	"	"	12	"	47 "	"
45 "	5	"	"	16	"	115 "	"
60 "	0	"	"	17¾	"	150 "	"

Dimensions, etc., of the 110 ton ("Armstrong Gun") English gun, breech-loader: Caliber, 16.25 in.; length, 43 feet; length of bore, 30 feet; weight of gun charge, 900 pounds powder; weight of projectile, 2,240 pounds; length of projectile, 4½ feet; range, 10 miles, at high elevation, 13 miles; muzzle velocity, 2,128 feet per second; energy, 56,520 foot-tons; penetration, 33.8 inches in wrought iron, will withstand a pressure of 30 tons to the square inch.

The big German gun, of Krupp, weighs 150 tons; the projectile, 3,300 pounds; the length is 60 feet; charge of powder, ½ ton range, 10½ m les.*

At the Centennial Exposition is a wooden model of the shell of the Krupp gun, which is 6 feet high and 1½ feet in diameter, or 4½ feet circumference.

Instead of the old-fashioned 12 inch and 13 inch mortars, we now have a long 12 inch howitzer, firing a bomb-shell, and with seventy pounds of powder it has a range of six miles. Fired at an angle of 75° the shell can be thrown to the height of three miles.

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*Length of charge, 6 feet 4 inches, second half with a cylindrical space or fine grained powder; length of shell, 4 feet 7 inches; weight of charge, ,800 pounds; charge of shell, 200 pounds.

We have "disappearing carriages," by means of which the gun can be dropped down out of sight, and out of horizontal fire of the enemy—Major King's counterpoise carriage for muzzle loaders, and the Elswick hydro-pneumatic carriage for breech-loaders. They are protected with armor-plated shields or turrets.

We have the Gruson armored battery, with embrasures of chilled iron, a model of which is to be seen at the Exposition building in Cincinnati.

To operate the very big guns, we require complicated carriages, on which the gun is mounted with hydraulic jacks for lifting, pneumatic cylinders for checking recoil, and various levers for moving the gun by hand, for opening and closing the breech, hoisting and inserting the charge - machines which require for their manipulation and repair a skilled mechanical engineer.

Other nations have these war appliances, and we are compelled to keep pace with them or be at their mercy in time of war.

The multiplicity of devices displayed in the War Department Exhibit of the Centennial Exposition, demonstrates the necessity of complete records, and of life study on the part of a certain set of officers, whose attention is constantly directed to these subjects.

The big guns of our late war were not of long life. One thousand rounds is considered the average life of such guns, but the Rifled Parrott Guns—100, 200 and 300 pounders—which we used at the bombardment of Charleston, S. C., many of them endured not more than 100 rounds. The first 200 pound gun placed in the Swamp Angel Battery, burst on the thirty-sixth round.

On the south end of Morris Island 24 bursted guns lay in fragments, and one a disabled Witworth gun. With many the butt-end of the breech was blown out of the wrought-iron jacket or reinforce. In others the body of the gun, owing to a transverse strain, was split into fragments along the lines of the axis of the bore. The grooves much eroded and the lands worn flat. These guns are quite expensive machines, for the new steel guns of Krupp cost about $1,000 per ton.

The fuzes necessary to explode the shells on their striking the point aimed at, are exhibited in great numbers, and are wonderful in contrivance.

We have three kinds, viz., time, percussion and concussion fuzes.

Among the best are the time fuzes, combined with the Laidley friction igniter, as seen in the Eureka Fuse.

A bad fuse will prematurely burst the shell in the gun and destroy the gun.

Mr. Parrott said that his big guns, in the Navy, endured well. This may have been due to the cleanness of the guns on the water, for on land the rifled grooves would get clogged with sand and earth thrown up by the enemy's shot, or introduced on the rammer.

Our Generals dislike to fire oftener than is necessary, as every shot diminishes the life of the gun. A perfect record is kept of each shot fired, and when 500 shots have been expended, the life of the gun is half over.

We had a 30-pounder on Morris Island which fired 4,606 times, at 40° elevation, and most of the shells, 4,253, reached the city of Charleston. I made a post-mortem portrait of the fragments.

At the mouth of the Savannah River, on Cockspur Island, stood a casemated fort, called Fort Pulaski. The walls were of the best brick, laid in hydraulic mortar or cement, and 7½ feet in thickness and 25 feet in height, surrounded by a ditch 45 feet wide and 6 feet deep. At the gorge, or back wall of the fort, was an earth-work, called a demi-lune, with a ditch 32 feet wide.

This fort was garrisoned by 360 men, with the full complement of officers, and was supplied with armament, ammunition and provisions. One would have thought this fort impregnable, especially as the nearest point for erecting the batteries was on the south bank of the Savannah River, one mile distant. It was there that General Gillmore established his batteries of Parrott and James' rifled guns. He opened fire on the 10th of April, 1862, and the fort surrendered at 2 P. M. on the 11th. In that short time a breach had been made through the 7½ feet thickness of wall of 30 feet wide, and then every shell was dropping on the powder magazines of the north and south ends of the gorge wall.

Without the effective powers of the big guns, Fort Pulaski was impregnable to all the efforts of infantry, cavalry and field artillery.

The breaching of the walls of such a fort, at a mile distant, was a new event in the era of military records.

The capture of the south end of Morris Island and Fort Wagner, with its strong bomb-proof shelter, adds more evidence of the efficiency of big guns.

Fort Sumter also was bombarded. It consisted of two tiers of casemates, and in a short time the upper row of casemates was

reduced to shapeless ruin, and all the guns on the top of the fort, or on the barbette plain, were dismounted or knocked to pieces.

Then by means of the Swamp Angel Battery, four miles south of Charleston, we were enabled to throw shells into Charleston, which on several occasions set fire to the city.

And, from Putnum, or Cumming's Point, we threw 4,253 shells, from one gun, into the city of Charleston. This rendered it uninhabitable to women and children, and converted the city into a mere soldiers' barracks, where no business could be transacted, no quiet or comfort obtained.

No wonder that soldiers get to love their big guns, which produce such marvelous effects of waste and destruction of the powers and resources of the enemy.

I can never forget the dying admiration of an Indian chief for the cannon of the white man.* He was buried in the Congressional Cemetery at Washington. He caused these words to be engraved on his monument: "When I am dead, let the big guns be fired over me."

A big gun needs no interpreter, it speaks the language of all nations, and when the black people of Charleston, S. C., heard the Swamp Angel, they cried out: "Hark! 'Tis the voice of an angel shouting freedom," and hence the battery obtained the name of, The Swamp Angel.

DISTRIBUTION OF VERNONIA IN THE UNITED STATES.

BY PROFESSOR JOSEPH F. JAMES, M.SC., MARYLAND AGRICULTURAL COLLEGE.

Read by Title December 4, 1888.

THE genus VERNONIA, named for Wm. Vernon, an early English collector of plants in Virginia, includes what are commonly called the "Iron-weeds." The common name has probably arisen from the tough nature of the stem, noticeable in most of the species. The genus is a large one, containing over 400 species; its headquarters is in South America, but it extends into North America, and has a few Asian and African, but no European, species. As given in the last edition (5th) of Gray's Manual, there are but two species in the north-east United States. The Synoptical Flora of the same author adds one species and two varieties to these. The additions are variety *latifolia*, Gr., of *Noveboracensis*, *altissima*, Nutt., and *altissima* var. *grandiflora*, Gray.

The geographical distribution of the species is interesting. Two, or possibly three, *Noveboracensis*, *fasciculata* and *altissima*, are widely scattered: the rest are local, some extremely so. Some of these are confined to the country west of the Mississippi, some to that part south of Tennessee and North Carolina. None grow farther north than Vermont or Massachusetts (although one species is found in Canada), in the east, nor Dakota in the west, and none are found farther west on the south than New Mexico, nor on the north, west of Kansas. Colorado and all the country westward has no species, nor indeed any closely-allied form. Most of the species grow in wet or at least damp soil, sometimes even in swamps, only few being found in dry soil, and these being very local. Out of the fifteen species and varieties credited to the United States, only five, one-third of the whole, are given as inhabiting dry soils or plains. This almost constant association with damp places seems to fully account for the absence of any species in the west, where dryness generally prevails. The further fact that the genus is one

of tropical nature will, on the other hand, account for its limited extension northward.

The two most wide-spread species are *fasciculata* and *Noveboracensis*. The first of these is mainly a central species, extending southward into Tennessee and northward into Canada. It is given in catalogues of plants of Ohio, Indiana, Michigan, Wisconsin, Iowa, Kansas and Minnesota. It is also mentioned in one list (Flora Columbiana) as occurring about Washington, although not in another (Ward's Guide to the Flora of Washington and vicinity), and is recorded from North Carolina (Curtis). These are *possible* errors. It would thus appear to be almost exclusively a Mississippi valley species, and wherever it grows it is certainly abundant. The other one, *Noveboracensis*, is, on the other hand, almost exclusively an eastern coast species, although recorded from the central States. It is given in catalogues of plants of Vermont, Massachusetts, New York (Long Island, Buffalo and Chautauqua), New Jersey, District of Columbia and North Carolina, but also from Tennessee (Nashville), Ohio, Indiana, Michigan, Wisconsin, Iowa and Minnesota There is a strong probability that variety *latifolia*, whose habitat is given as "Pennsylvania and Ohio to Florida," (Synop. Flora) is the prevalent form in the west rather than the type species. The suggestion is made that students look into their specimens named *Noveboracensis* and see if they really are the type and not the variety.

The additional species, *altissima*, newly added to the area covered by the "Manual," will probably be found in many places when sought after. It has as yet been recorded from Nashville only (Gattinger).

Two species, *angustifolia* and *oligophylla*, are strictly southern, neither of them being found north of North Carolina. The first, with one variety, *Texana*, extends west to Texas, but the second is an eastern species, extending from North Carolina to Florida, near the coast. Four of the others, viz., *Arkansana*, *Jamesii*, *Lindheimeri* and *Lettermani* are all strictly trans-Mississippi forms, found only in Nebraska, Kansas, Arkansas, Texas and east New Mexico. The one remaining species, *Baldwinii*, is given as western (east Missouri to Texas), but it is recorded from western Tennessee (Gattinger), but likewise from Michigan (Wheeler and Smith). We query whether this last may not be a mistake in identification. If correctly recorded in Tennessee it would indicate a tendency to spread eastward across the Mississippi.

The large number of flower-heads produced by each plant, and the number of flowers in each head, produce seeds that in the aggregate assume enormous numbers. One plant of *fasciculata* has been recorded as possessing no less than 3.290 flower-heads,* and these, if producing only twenty seeds each, a very moderate estimate, would give 65,800 fruits. This, as the product of a single plant, would be sufficient to stock a large tract of country. Each seed is provided with a number, about forty, capillary bristles, and these when ripe spread out into a head which is readily caught by the wind. As the fruits ripen the involucral scales spread, and leave the seeds standing free in the center. Ripening at a period when the winds generally blow strongly, there is every opportunity for them to be carried far and wide. Bearing this in mind it seems a little strange that so many of the species should be as local as they are. It may probably be accounted for by the late flowering habits of some, but more likely by the absence of certain necessary features in the surroundings.

It is natural to suppose two avenues by which the plants entered the United States. One by the way of the Florida Peninsula through the West India Islands from the mainland of South America; and the other by way of Mexico. into Texas and thence northward. Those entering by the first avenue would naturally spread northward along the peninsula, and mainly along the Atlantic Coast. They would most probably be plants loving damp or swampy places, such being the character of the ground they would have to cross. If spreading to the westward they would be mainly confined to the coast region. Those entering from Mexico would follow the streams, or even slightly encroach upon the adjacent higher grounds. The species entering from Mexico would migrate northward and eastward, mainly because the prevailing winds are from the south and west.

That the wind is a most potent agent for their dissemination can scarcely be denied. Baron Eggers says in regard to some of the West India Islands (Flora of the St. Croix and Virgin Islands), that until about August the winds blow constantly from the northeast. But between August and November they become unsteady and uncertain. This is the season for hurricanes and it is also about the season when *Vernonia* seeds are ripe. Thus, if then taken up by the winds, they would be carried a long way and be

* *Botanical Gazette* II, p. 121.

ready to germinate in due season if blown to a fit spot. We find now that, leaving out the widely dispersed forms, all the western species are close allies, while those of the east are also closely related.

It would appear that two sections can be formed of the species of the genus. One of these has ample, generally lancaolete, leaves, and the other has linear leaves. In the first group there are seven, and in the second, eight species and varieties. Of the lanceolete-leaved forms one is strictly southern and eastern (*oligophylla*), one is western (*Baldwinii*), but all the others are general in their distribution. But *Baldwinii*, the western species, is said to "pass into" *altissima*, one of the generally distributed forms, so it may be regarded as a form developed under special conditions. In the linear-leaved section, six out of eight are western; one of the others, *angustifolia* var. *scaberrima*, extends from South Carolina to Florida, and the other, var. *pumila* of the same species, is found in South Florida.

The first group of ample-leaved forms may be regarded as coming from the south by way of the West Indies and Florida, spreading in several cases far northward and westward, and in others adhering to the Atlantic Coast. The second group, that of linear-leaved forms, probably arrived by way of Mexico, and then spread north and east; in the latter direction partly because of the prevailing direction of the wind, partly because of the dryness of the country to the west. Besides the leaves, there is a prominent feature in some species of long filiform tips to the involucral scales. These do not seem to be correlated in any way with the lanceolate or linear leaves, nor with the distribution. The table given below represents the distribution of the two groups of species:

Leaves linear:

Arkansana: Missouri, Kansas to Texas.
Jamesii: Nebraska and Arkansas to Texas.
Lettermani: Arkansas and Texas.
angustifolia: North Carolina to Florida, Arkansas and Texas.
var. scaberrima South Carolina to Florida.
var. Texana: Arkansas, Louisiana and Texas.
var. pumila: Southern Florida.
Lindheimeri: West Texas.

Leaves lanceolate:

Noveboracensis: General but mostly eastern.
var. latifolia: Pennsylvania and Ohio to Florida.

Baldwinii: East Missouri (West Tennessee) to Texas.
altissima: West Pennsylvania to Illinois, Louisiana and Florida.
var. grandiflora: Illinois and Kentucky to Texas.
fasciculata: General, but mostly central.
oligophylla: North Carolina to Florida.

A last peculiar feature of the genus, and one that adds to its difficulty, is the occasional occurrence of natural hybrids between several distinct species. These have not been fully investigated, and the only mention found of them is in the "Synoptical Flora." Here it is stated that hybrids between *Arkansana* and *Baldwinii*, between *fasciculata* and *Baldwinii* and between *Lindheimeri* and *Baldwinii* have been found. The last was collected by Berlandier. May it not be that *Baldwinii* is itself a hybrid?

NORTH AMERICAN FUNGI.*

BY A. P. MORGAN.

(Read by title, Dec. 4., 1888.)

THE GASTROMYCETES.

FRUCTIFICATION arising from a simple filamentous or from a compound mycelium, comprising essentially a closed sac or PERIDIUM inclosing the hymenial structure called the GLEBA; hymenium lining or filling the chambers or CELLS of the gleba, consisting of numerous closely-packed branches of the hyphæ forming the basidia and paraphyses; basidia producing laterally or at the apex one to several spores, sessile or borne on sterigmata; spores spherical or elliptic, continuous, hyaline or colored.

*The following letter to a member of the Publishing Committee is printed by permission of the writer:

PRESTON, HAMILTON CO., O., *December* 29, 1888.

MR. DAVIS L. JAMES:

Dear Sir—Along with this I send you the manuscript of the article on *Phalloideæ*. You will perceive by the title and by the contents that it is more ambitious in plan than the preceding papers. The remaining classes of Fungi are better known, and the specimens are more easily preserved and accumulated than the *Hymenomycetes*. Hence, I think, papers covering the whole field of our country, so far as at present investigated, will be far more acceptable. The *Gastromycetes* will occupy about three such papers as the present; possibly, the next two may fill a little more space.

The next paper will be on the *Lycoperdaceæ;* it is now under way and partly done. I will try and have it ready for the April number, unless the space is wanted for other matter.

The new species we had taken for *Mutinus caninus*, until the publication lately, in Grevillea, of a figure and description of that species, showing it clearly to be a different thing. It was at first supposed to be *Corynites Ravenelii*, B. & C., but the figure and description of this species show a much smaller plant with a different form

No sytstematic paper on the *Gastromycetes* has ever before been attempted in this country. The only essays hitherto attempted have been two papers,

The Gastromycetes are fungi mostly of large size, growing usually upon the ground sometimes just beneath its surface, rarely upon wood. Their mycelium often exhibits an extensive development, the hyphæ uniting together into strands which in form branching and mode of growth in the substratum simulate the roots of higher plants. The peridium is a closed wall of dense texture mostly spherical in form and often of considerable thickness; it may consist of a single coat of uniform texture or more commonly it is separable into two distinct layers the INNER and the OUTER peridium. In many cases the peridium is extensively and peculiarly differentiated partly into persistent and partly into temporary parts; it is a general occurrence in the course of this differentiation that the peridium becomes strongly thickened at the base; the thickened portion either projects outward forming a stout support to the gleba or it projects inward forming a cushion of moderate thickness or an elongated vertical central column. The chambers or the cells of the gleba generally are in countless numbers seldom few and definite; they are narrow irregularly curved and branched cavities scarcely large enough to be distinguished by the naked eye. In some cases the gleba retains this primary structure throughout its entire existence, subject only to the changes in size of all its parts caused by growth and maturity; in other cases the cells of

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one on the genus *Lycoperdon*, by Chas. H. Peck, the other on the genus *Geaster*, by myself.

It is true, these are the large genera and contain half the species of the whole class. The genera of the different Orders stand about as follows:

ORDER.	*Genera.*
Phalloideæ,	5
Lycoperdaceæ,	10
Sclerodermaceæ,	7
Hymenogastraceæ,	6
Nidulariaceæ,	5
Gastromycetes,	33

Our own region, the Miami Valley, is remarkably prolific of puff-balls, and I have probably seen more of these things living and growing than any other person in the world. I have specimens of nearly every species that have been found in the United States, and among them quite a number that have not yet been noticed in print.

Very truly, yours,

A. P. MORGAN.

the gleba large and few in number are specially segregated into distinct closed PERIDIOLA containing the spores; in the most of cases however after the formation of the spores disorganization of the hymenial elements ensues caused by deliquescence. The changes in the gleba are always accompanied by corresponding varied and sometimes remarkable transformations of the peridium; the thickened base may be developed downward into a distinct STIPE with the entire peridium upon its apex; it may be developed upward into a STIPE carrying the gleba or the inner peridium at its apex, while in the one case the whole peridium in the other its outer layer remains behind as a VOLVA to the base of the stipe.

TABLE OF ORDERS OF GASTROMYCETES.

A. TERRESTRIAL.

a. Peridium double.

1. PHALLOIDEÆ. Peridium becoming transformed into a receptacle of various shape, with a volva at its base. Gleba becoming dissolved into a dark green mass of jelly.

2. LYCOPERDACEÆ. Peridium sessile usually with a more or less thickened base or sometimes stipitate, at maturity filled with a dusty mass of mingled threads and spores.

b. Peridium single.

3. SCLERODERMACEÆ. Peridium discrete from the gleba, often with a columella; cells of the gleba subpersistent.

4. HYMENOGASTRACEÆ. Peridium concrete with the gleba, indehiscent; cells of the gleba persistent.

B. EPIPHYTAL.

5. NIDULARIACEÆ. Peridium cyathiform, open at the top, containing one or more distinct peridiola.

ORDER I.—PHALLOIDEÆ.

Mycelium funicular, rooting extensively. Peridium at first ovoid, with an inner and outer coat and a thick gelatinous layer between them, traversed by a central column surrounded by the gleba; at length ruptured by the development of a receptacle of various shape bearing the gleba, and remaining as a volva at its base. Gleba becoming dissolved into a mass

of jelly which dissipates in water and like the spores is of a dark green color; spores elliptic oblong, even, minute, 3–5 mic. in length.

Fungi terrestrial, of large size, characterized by receptacles exceedingly remarkable for their varied and singular shape, and possessing an extremely offensive odor.

TABLE OF GENERA OF PHALLOIDEÆ.

I. PHALLEÆ. Receptacle consisting of an elongated stipe bearing the gleba on a conical pileus at its apex.

1. PHALLUS. Pileus attached only to the apex of the stipe, dependent free all around below.

2. MUTINUS. Pileus wholly adnate to the summit of the stipe.

II. CLATHREÆ. Receptacle a hollow clathrate body, with the gleba attached to the upper part of the inner surface.

3. CLATHRUS. Receptacle composed oi obliquely anastomosing bars and sessile.

4. SIMBLUM. Receptacle composed of obliquely anastomosing bars and stipitate.

5. LATERNEA. Receptacle composed of a few vertical columns and sessile.

I. PHALLEÆ. Receptacle consisting of an elongated stipe bearing the gleba on a conical pileus at its apex. Stipe cylindric, hollow, composed of one to several layers of round-celled tissue; the gleba accupying the outer surface of the pileus.

GENUS I.—PHALLUS, MICH.

Stipe hollow within, the wall composed of several layers of round-celled tissue; pileus attached only to the apex of the stipe, dependent free all around below, the gleba occupying its outer surface.

The genus may be divided into two subgenera by the presence or absence of an appendage called the *indusium* or *veil* hanging from the apex of the stipe beneath the pileus; this veil in one group is evidently the outer cellulose layer of the stipe, in the other it is the thin membrane which separates the stipe from the pileus.

I. HYMENOPHALLUS. An indusium or veil surrounding he stipe and dependent from its apex beneath the pileus.

a. Veil reticulate, hanging below the pileus..

1. P. DÆMONUM, Rumph. Volva globose, not very thick, pinkish; segments 3 or 4, irregular. Stipe cylindric, tapering at each end, cellulose; the veil reticulate, somewhat expanded and campanulate, hanging nearly to the middle of the stipe. Pileus campanulate, somewhat oblique; the surface reticulate-pitted after deliquescence; the apex truncate, smooth, perforate. Spores elliptic-oblong 4 × 2 mic.

Growing on the ground in woods. New York, PECK; Maryland, *Miss Banning;* Ohio, *Lea, Morgan.* Plant 9 inches high, volva 2 inches in diameter, stipe 1⅛ inches thick at the middle, pileus 2 inches in height; the lower edge of the veil hangs about 4 inches from the apex of the stipe. This species is rare and not well known, the original description, like those of many of the Phalloids, is brief and unsatisfactory. We have thus far met with but a single specimen of what we take to be this plant; this we carefully figured and our discription is based upon it; of course other specimens will vary somewhat in size. The short veil and the smooth ring at the apex will distinguish this species from the next.

2. P. DUPLICATUS, Bosc. Volva depressed globose, thick, flabby white; segments 3–5, acute. Stipe fusiform-cylindric cellulose; the veil reticulate, hanging down to the volva, sometimes much expanded, often torn and shreddy with pieces adherent to the stipe. Pileus campanulate, reticulate-pitted after deliquescence; the apex acute, not regularly perforate. Spores elliptic-oblong, 4 × 2 mic.

Growing in woods about old stumps and rotten logs. New England, *Frost, Wright, Sprague, Farlow*; New York, *Gerard*; Pennsylvania, *Schweinitz, Rau;* Carolina, *Schweinitz, Ravenel*; Ohio, *Morgan.* Plant 6–8 inches high, volva 2½ inches in diameter, stipe 1¼ inches thick in the middle, pileus 2 inches in height. The long veil usually clings close to the stipe though sometimes swinging free and much expanded. The size of the meshes must be of uncertain value as a specific character, for the expansion of the veil is no doubt caused by the swinging in the breeze stretching its tissue and causing the upper meshes which bear the greatest weight to be the longest. The plants found in this country and called P. INDUSIATUS, Vent. are most likely referable to this species. In this species the gleba extends over the apex and

there is no thick smooth ring encircling the perforation as in the preceding species.

b. Veil not reticulate, concealed beneath the pileus.

3. P. RAVENELII, B. & C. Volva sub-globose or ovoid, pinkish; with an inner membrane, the lower half of the veil, surrounding the base of the stipe; segments 2 or 3. Stipe cylindric, tapering at each end. cellulose; the veil membranous, scarcely half as long as the pileus and concealed beneath it. Pileus conic-campanulate; the surface not reticulate-pitted after deliquescence; the apex smooth and closed or finally perforate. Spores elliptic-oblong, 4×5–2 mic.

Growing in woods and fields about rotting stumps and logs. New York, *Peck;* S. Carolina, *Ravenel;* Ohio, *Morgan.* Plant, 5-7 inches high, volva, 1½-2 inches in diameter; stipe nearly 1 inch thick; pileus 1½ inches in height. The apex is umbilicate or finally perforate and encircled by a smooth ring. By the elongation of the stipe the thin membrane separating the stipe from the pileus is rent midway by an annular fissure, the upper half becoming loosened forms the short veil under the pileus, the lower half remaining within the volva about the base of the stipe. It is probable that in some instances the hidden veil has not been detected and plants of this species have been referred to the following one. This species vitiates the genus *Dictyophora* and it can not very well be placed in *Ithyphallus.*

II. ITHYPHALLUS. Stipe without an indusium or veil dependent from its apex.

4. P. IMPUDICUS, Linn. Volva globose or ovoid, white or pinkish; segments 2 or 3. Stipe cylindric, tapering at each end, cellulose, without a veil. Pileus conic-campanulate; the surface reticulate-pitted after deliquescence; the apex smooth, at first closed, at length perforate. Spores elliptic oblong, 4–5×2 mic.

Growing on the ground in woods. New England, *Frost, Farlow* New York, *Peck, Gerard*; Carolina, *Schweinitz*; Ohio, *D. L James;* Nebraska. *H. J. Webber;* California, *Harkness.* Plant 6-8 inches high, volva 2 inches in diameter, stipe 1¼ inches thick, pileus 2 inches in height. By the elongation of the stipe the thin membrane which separates the stipe from the pileus is torn into shreds and the pileus is thus liberated from the stipe except at the apex.

5. P. RUBICUNDUS, Bosc. Volva small, gray. Stipe fusiform,

red, cellulose, without a veil. Pileus conic-campanulate, bay, the surface even, the apex perforate.

Growing on the ground about old stumps. New England, *Frost;* New York, *Schweinitz;* N. Carolina, *Curtis*; S. Carolina, *Ravenel*; Alabama, *Peters.* Plant 6-7 inches high, stipe about ¾ of an inch thick in the middle, pileus 1 inch in height. This plant though so frequently met with does not appear to have been described again since the time of Bosc; it is desirable that some one finding it should make a careful study of it and give a fuller description.

Genus II. MUTINUS, Fr.

Stipe hollow within, the wall composed of a single layer of round-celled tissue; pileus wholly adnate to the summit of the stipe, the gleba occupying its outer surface.

1. M. CANINUS, Huds. Volva ovoid or oblong, pallid; segments 2 or 3. Stipe cylindric, white or reddish, cellulose, tapering downward. Pileus determinate, oblong-ovoid, flesh-colored; the apex acute, perforate or imperforate. Spores elliptic 6×4 mic.

Growing on the ground in woods. New England, *Frost;* New york, *Warne.* Plant about 6 inches in height, the stipe ½ an inch thick, the pileus occupying nearly 1 inch of the apex, volva 1 inch in diameter. This species is nearly destitute of the peculiar Phalloid odor. A figure of it may be seen in Grevillea, Vol. 17, plate 173.

2. M. BOVINUS, Morg. n. sp. Volva oblong-ovoid, pinkish; segments 2 or 3. Stipe cylindric, tapering gradually to the apex, white or pinkish below, bright red above. Pileus indeterminate, conic-acuminate, perforate at the apex. Spores elliptic-oblong, $4—5 \times 2$ mic.

Growing in rich soil in cultivated grounds and in woods. Ohio, *Morgan.* Plant 4-7 inches in height, the stipe ¾ of an inch in thickness, the volva not much thicker and 1-1½ inches in height; the pileus occupies 1-2 inches of the pointed apex, but is not definitely limited below. This plant has the strong disagreeable odor of other Phalloids. See plate III.

3. M. BREVIS, B. & C. Volva globose or ovoid; segments 2 or 3. Stipe bright red, coarsely cribrose, attenuated below. Pileus somewhat broadly clavate, sometimes conical, but always more or less obtuse, perforate at the apex.

Growing on the ground in fields and gardens. New England,

Wright; New York, *Peck, Howe, Gerard;* Carolina, *Curtis, Ravenel.* Plant 2-3 inches high, stipe 4-5 lines thick, the volva ¾ of an inch in diameter, the pileus sometimes half as long as the stipe. This is *Corynites brevis,* B. & C. of Curtis's Catalogue; it was afterward described in Grevillea under the name *C. Ravenelii,* B. & C. *C. Curtisii,* Berk does not appear to possess any distinctive marks separating it from the present species. See Transactions Linnæan Society, Vol. xxi, p. 151, tab 19.

II. CLATHREÆ. Receptacle a hollow clathrate body composed of oblique bars or vertical columns with the gleba attached to the upper part of the inner surface.

Genus III. CLATHRUS, Mich.

Receptacle a sub-globose hollow net or lattice-work, composed of several obliquely ascending and anastomosing bars, forming numerous meshes, and sessile within the volva. Gleba enclosed within the net and attached to the upper part of the inner surface.

1. C. CANCELLATUS, Tourn. Vòlva sub-globose, burst irregularly into several segments. Receptacle obovoid, sessile; the bars variable in width, more or less compressed, transversely wrinkled, forming irregularly polygonal meshes, red rarely yellow or whitish.

Growing on the ground in woods. New York, *Clinton;* Georgia, *LeConte.* Plant 3-5 inches in height, the volva 2-3 inches in diameter. Possessing an extremely fetid odor.

2. C. CRISPUS, Turp. Volva globose, burst irregularly into several segments. Receptacle globose, sessile; the bars transversely wrinkled and knotted, cinnabar-red; the meshes round or oval, very large below and in the middle, very small at the apex.

Growing in sandy woods. Mexico, *Leveille.* Plant 2-4 inches in hight, the volva 2-3 inches in diameter.

Genus IV. SIMBLUM, Klotsch.

Receptacle a sub-globose hollow net or lattice-work, composed of several obliquely ascending and anastomosing bars forming numerous meshes, and borne at the apex of an elongated stipe; stipe hollow, composed of several layers of round-celled tissue. Gleba enclosed within the net and attached to the upper part of the inner surface.

1. S. RUBESCENS, Gerard. Volva sub-globose, whitish, burst irregularly into 3 or 4 segments. Receptacle depressed globose,

deep fleshy red, stipitate; the bars compressed and transversely wrinkled, forming pantagonal meshes; the stipe cylindric, cellulose, red above, paler below, tapering toward the base, rounded at the apex and strongly constricted at its junction with the receptacle. Spores elliptic-oblong, 3 mic. in length.

Growing among grass in open land. Long Island, N. Y., *Gerard;* Nebraska, *H. G. Webber.* Plant 3-5 inches in hight, stipe ½-1 inch in diameter at the thickest part, the receptacle always a little broader than the stipe; meshes about 26 in number. Odor slightly nauseous.

Genus V. LATERNEA, Turp.

Receptacle a more or less elongated body, consisting of a few vertical columns arising separately from the base of the volva and joined together only at the apex. Gleba suspended from the apex within the receptacle.

1. L. COLUMNATA, Bosc. Volva obovoid, burst irregularly into 3 or 4 segments. Receptacle composed of 4 vertical columns; the columns thick, 4-angled, tapering upward, cinnabar-red. Spores elliptic-oblong, 4–5 × 2 mic.

Growing in sandy woods. North Carolina, *Curtis;* S. Carolina, *Bosc, Ravenel*; Georgia, *LeConte*; Florida, *Ravenel.* Plants 3-5 inches in height, the volva 1½-2 inches in diameter. Extremely fetid.

2. L. TRISCAPA, Turp. Volva obovoid, bursting irregularly into 2 or 3 segments. Receptacle composed of 3 vertical columns; the columns slender, terete, tapering upward, white below cinnabar-red above.

Growing in sandy soil. Texas, *Ellis.* Plant 2-3 inches in height, volva 1½ inches in diameter.

"RIVERSIDE SKULL."

BY A. J. HOWE, M. D.

(Read, Dec. 4. 1888.)

AT the November meeting of the Cincinnati Society of Natural History were exhibited two fossil specimens, the one being a human cranium, and the other a part of an elephantine tusk in a fragile state. Both relics were unearthed two or three miles down the river by workmen quarrying gravel for railroad purposes at Riverside; and were cared for by Dr. Kusnick of that place. He reports that the "remains" were encased in coarse gravel — the skull was found in the first cut made in the terrace north of the railway. It rolled down with a mass of gravel and clay, rendering it impossible to decide upon the exact position of its original bed. The tusk was found in the second cut, and at an equally uncertain depth. It had lost its character as ivory; and was too brittle to be handled without breakage. A sharp curve near its apex, together with its great size at the base, indicates that the dental product belonged to a mastodon. An elephant's tusk is less curved toward the point.

The cranium was fragmentary, yet the walls of the brain-case are well preserved. The specimens were entombed in river drift or wash, yet at a point too high to be reached by recent or modern inundations. The pebbly bank in which they rested was deposited when the Ohio flowed at a higher level than it does at present. The pile of gravel in which they were found constitutes the middle one of three ridges the river has developed in its washings through a series of centuries. The "bottom," or lower portion of Cincinnati is on the first terrace; a plateau sixty feet higher, on which most of the city is built, has been called the "second terrace;" and the high banks above may be termed the "third terrace." The first terrace is subject to annual overflow. The river has evidently cut its way down to its present channel, the rate of erosion being estimated at a foot in a century. The cutting process may have been more rapid at an early period of the history of the Ohio Valley.

At several points in America the remains of man and the mammoth are found in the same locality. In Europe a similar state of things has been observed. In the Madeline cave of Dordogne, a plate of ivory was discovered, having engraved upon it the figure of a mastodon, with eyes, tusks, and general shape so exact that the barbarian artist who lived cotemporaneously with the beast, must have had a living specimen to sketch from. The engraved tusk of ivory was found in such relationship with the implements of the earlier races of mankind that there can be no question in regard to the existence of the two beings at the same time.

But in this departure from my chosen topic I have not intended to convey the impression that the Riverside skull and the tusk found above it were anything more to each other than that they were incidentally engulphed in the same gravel pit.

The orbits of the cranium, the nasal chambers, the aural cavities, and other crevices were packed with a clayey soil peculiar to the earth on the top of the hill, above the gravel bank. It is highly probable, then, that in land slides which are constantly occurring along the crest of the ridges overhanging the river basin, the skull was carried from its original burial place down the steep declivity to the pebbly bed where it was lately found. During some inundation subsequent to the slide, the tusk plunged from its primary resting place higher up the river, and lodged in the superimposed gravel, where it was at length disentombed by railroad navvies. The fragile condition of the ivory— a material which resists disintegration longer than bone—shows that the tusk has been subjected to the ravages of time much longer than the fairly-preserved cranial bones. Mere superposition in the shifting banks of a large river is an unreliable test of the relative antiquity of imprisoned objects.

The cranium, or what remains of it, is browned with the alluvium of its original interment; and is somewhat fragile. The bones of the face are lost · both maxillæ are wanting, also the malar bones, as well as those of the nares. The ethmoid is gone, and parts of the sphenoid; but the plates of the skull have maintained the boundaries of the cranial cavity. The outline of what is left quite accurately represents the average brain-pan of the savage Indian, or of the Moundbuilder. The forehead is rather low and notably retreating, though not to a degree to be called simian — not even equal to that of the lowest savage. The upper jaw being absent, "the facial angle" can not well be determined. However, it is far from

being as near a right-angle as that of Agrippa, or of approaching a match for the ideal "front of Jove." But the facial angle established by Camper does not mean as much as its author would have us believe. The skull of the Marmoset monkey presents an approach to a right-angle as near as that of a philosopher. Mental capacity depends not altogether upon a prominent forehead, but largely upon the quantity and quality of the brain, as a whole. Even a big brain is sometimes indicative of a block-head. The absence of jaws in a cranium makes the forehead appear low and sloping. Actual measurements of the Riverside skull do not sustain the impression of its being pithecoid. External tests with callipers show its longest diameter - from glabella to inion—to be 7 inches, its width between parietal prominences to be 5½ inches and from vertex to basilar process of occiput to be 5⅓ inches; These measurements indicate that the cranium is neither dulich. ocephalic (long-headed) nor brachycephalic (short-headed). The. zygomatic processes are only averagely developed, and the temporal fossæ are not decidedly deep, to represent unusually powerful masticating muscles. The brain-pan is as capacious as that of the average savage—almost as large as that of the medium white man. The Riverside skull holds 90 cubic inches, therefore a brain which would fill the cavity must weigh 57⅛ ounces. The cranial capacity of a Digger Indian, whose skull was sent from California, is identically the same—90 cubic inches. In making the measurements, avoirdupois weight was employed. Troy ounces are for weighing gold, silver, and medicines. The avoirdupois scheme calls for 437½ grains to the ounce, and 7,000 grains to the pound. The metrical system is at present in reputable use for scientific measurements, but is not in common employment. A *gramme* contains 15.5 grains, therefore it is a mere matter of mathematics to ascertain how many *grammes* there may be in one ounce. I have learned experimentally that there are 278 grains in a cubic inch of human brain, hence it is a sum in arithmetic to determine how many grains or ounces, or even *grammes*, there may be in so many cubic inches. A cup an inch square represents a cubic inch; and if small seeds be used to pour from the full cup into the foramen magnum of a skull, the cubic capacity of the brain-pan may be ascertained. If the number of cubic inches be multiplied by 437½, and the amount be divided by 278, the number of avoirdupois ounces may be learned.

Certain craniologists have employed Troy weight to determine the ounces a brain may weigh, hence some confusion has arisen as to cerebral ponderosity. The brain of Cuvier weighed 1861 *grammes*=28945 grains—or 66 ounces; that of Byron weighed 1807 *grammes*= 28009 grains, or 64 ounces. The brain of Agassiz weighed 64½ ounces, and that of Humboldt 65½ ounces. These figures are only approximately exact.

The other day I selected two skulls from our Madisonville collection, the larger would hold 57 ounces of brain, and the smaller 42 ounces. The smallest approaches the diminutive in capacity; while the largest attains the dimensions of the very biggest skulls. A man has a large brain which weighs 56 ounces. The smallest brain in the Leipsic collection—that of a native Australian—weighed 35 ounces. The gorilla and the chimpanzee have brain-pans which hold from 28 to 36 cubic inches, which weigh from 20 to 25 ounces of brain. There is a pronounced difference between the cranial capacities of the larger apes; and there is considerable difference between the largest anthropoid brain and that of savage man. Approach in size means very little. A whale has as large a brain as is possessed by a statesman. An elephant has more brain than any other animal.

In regard to the age of fossils, I beg to say that great scope is given to speculation. A petrefaction is a fixture—it belongs to some geological era or epoch, with relationship to other periods in palæontological history; but a fossil picked out of the drift in a pile of river gravel is an object upon which there may be ventured the wildest theory as to its perambulations. If we could determine the period at which the Ohio ranged fifty feet higher than it now does, we might conjecture the age of the Riverside skull. From what scientists write in regard to the time when the first organism appeared upon our planet, carrying the event back millions of years, the discrepancy of a thousand years might be made in the reckoning, and the result be not far out of the way. In the infinity of time the span of a century is an insignificant leap—is as a day or an hour. The skeletons of the Madisonville cemetery were overgrown with forest trees whose annular rings count 700 or more. Probably the burials reach back 800 or 1,000 years. An older history can not be claimed for them. I conjecture that the Riverside skull is as ancient as any of the crania in our cabinet, unless there be an embalmed Egyptian skull in the collection. Skeletons

taken from the pits of the older mounds are very fragile—time has disintegrated them.

A few years ago the underjaw of an elephant (extinct variety) was unearthed while quarrymen were excavating a sewer on Central Avenue (this city). The bone was at least 40 feet above the late inundation, and deeply buried in gravel, and in a too good state of preservation to be ten thousand years old. In a cave or peat-bog, where chemicals of a protective nature are present, a bone may be preserved a million of years, but not in a gravel bank. In the course of time a bone loses its cohesive properties, and crumbles like slacked lime. Possibly the elephantine maxilla recently exhumed, and the fossil skull, have been buried in their pebbly beds for 1500 years; yet their firmness could not be maintained for thousands of years. It will be excusable in me if I do not venture into a broader speculation; but the subject is open to free discussion. That the Borreby skulls of Denmark, and the Enghis and Neanderthal crania, are older than the one under observation, I have not the slightest doubt. In fact, I look upon this as comparatively modern. There is a question about the antiquity of the Calaveras skull—an earthquake may have determined the overlay or superposition. Herculaneum was buried two thousand years ago; and the skeletons of the overwhelmed inhabitants are well preserved; and it is not improbable that they may continue to resist disintegration for ten thousand years. I mention the circumstances to illustrate how uncertain it is to speculate upon the age of fossils.

ADDITIONS TO THE LIBRARY OF THE CINCINNATI SOCIETY OF NATURAL HISTORY.

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Chas. E. Beecher, New Haven, Author: A Method of Preparing for Microscopic Study the Radulæ of Small Species of Gasteropoda.

Hon. Chas. Bird, City. Fifteen Copies of Vol. VI. Geological Survey of Ohio. With Maps.

D. G. Brinton, M. D., Philadelphia, Author: On the So called Alaguilac Language of Guatamala.

On An Ancient Human Foot-print from Nicaragua.

Amos W. Butler, Brookville, Author: Land and Fresh Water Mollusca in Franklin Co., Ind.

The Remains at San Juan Teotihucan.

Local Weather Lore.

Notes on Range of Prothonotary Warbler, (in Ornithologist and Oologist, Mar. 1888.)

Observations on Faunal Changes.

Periodical Cicada in S. E. Indiana, (in U. S. Dep't of Agriculture. Ent. Bulletin No. 12.)

The Habits of Some Arvicolinæ.

The Sacrificial Stone of San Juan Teotihuacan.

List of Birds Observed in Franklin Co., Ind.

Observations on the Muskrat.

Hibirnation of the Lower Vertebrates.

Prof. E. W. Claypole, Akron, Author: The Material of the Appalachians.

Sam'l Garman, Cambridge, Author: On West Indian Reptiles and Batrachians.

Natural History Notes.

On the Reptiles and Batrachians of Grand Cayman.

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3, 7, 11, 13, 21, 22, 24, 25 to 28, 34, 35, 42, 44, 46 to 51, 53, 54, 57, 58, 60, 62, 64, 65, 67, 68.

General Reports: Nos. 69, 70, 73 to 76, 81, 83, 84, 86, 88, 89.

Special Reports: 24½, Ostrich Farming in United States; 37, Petroleum and Kerosene Oil in Foreign Countries; 41½, Fruit Culture in the Several Countries; 43, On Credit and Trade Systems; 56, Declared Exports for the United States; 59, Leather and Shoe Industries; 66, Agriculture and Manufactures; 68½, Scope and Methods of Consular Trade Reports; 85, Statistical Abstract for Foreign Countries; 87, Bimetallism in Europe; 90, Budgets and Budget Legislation in Foreign Countries; Agriculture in Germany; Register of the Department of State, 1887; Tariffs of Spain, Norway, etc., Dec. 1882; The Licorice Plant; Pounding and Polishing Rice in England and Germany; Cholera in Europe in 1884; Trade Guilds in Europe; Labor in Europe; Index to Consular Reports; Miscellaneous Documents.

A. J. Howe, M.D., Cincinnati, Author: Michæl Angelo. Depressions in the Earth's Surface.

Prof. Jos. F. James. Vick's Illustrated Monthly, Jan. 1884. Audubon Magazine, May 1887.
The Book Buyer, Vol. V. No. 1.; Grasses of the United States; Bulletin No. 2, American Ornithological Union; Hoosier Naturalist, Mar. 1887; Common Sense, Vol. II. 3. Conchologist's Exchange, Vol. II. Nos. 2, 4; Microscopical Bulletin, June, Oct. Dec. 1887. Feb. 1888; Science; Journal of Pedagogy, Dec. 1887; Annals of Mathematics, April 1888.

U. P. and Jos. F. James, Cincinnati, Authors: On the Monticuliporoid Corals of the Cincinnati Group.

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Om Ett Konglomerat Inom Urberget vid Vestana I Skane.
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Post, H. V., Ytterligare Om Nickelmalmfyndigheten vid Klefva.
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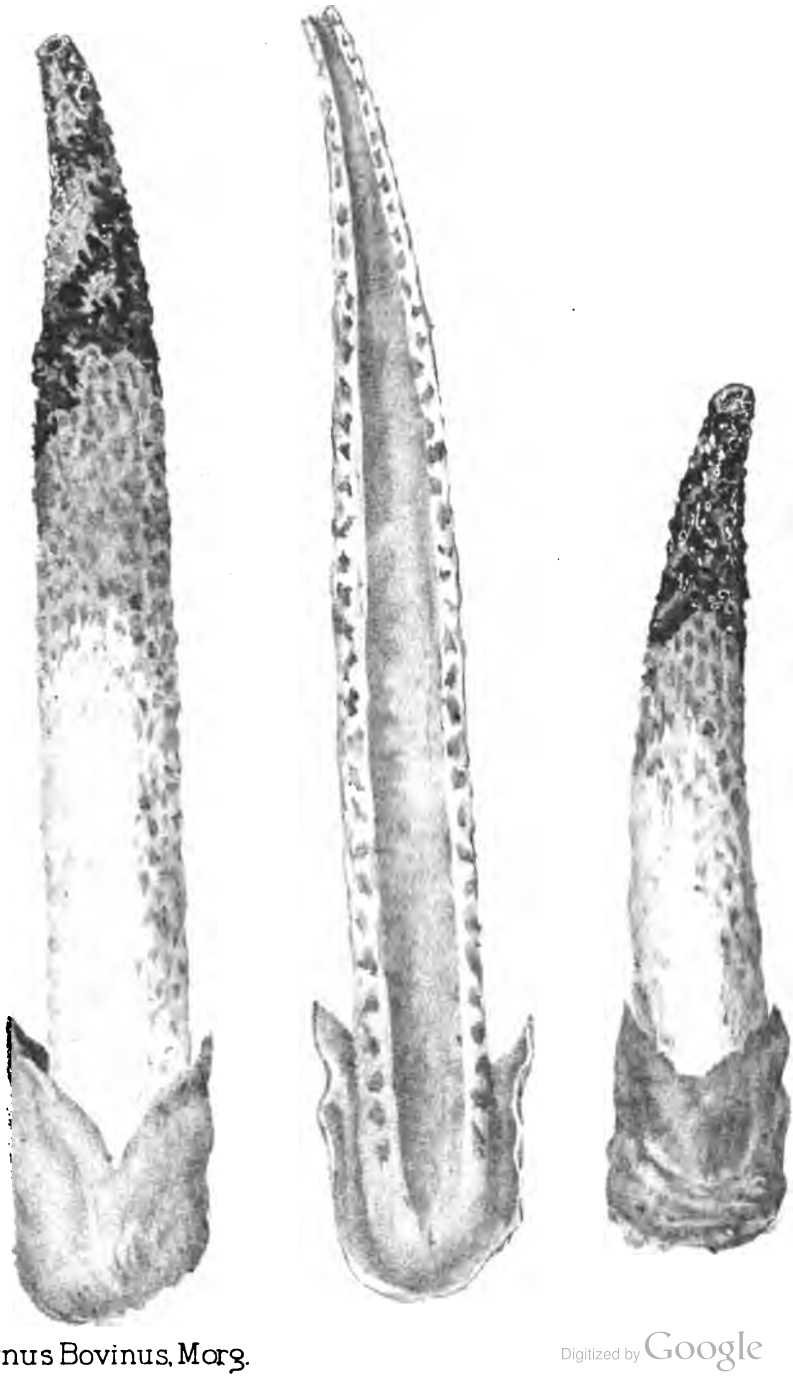

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Laura V. Morgan Del.

The Krebs Lith Co. Cincinnati O.

ANNOUNCEMENT.

THE Lecture Committee of the CINCINNATI SOCIETY OF NATURAL HISTORY takes pleasure in offering to the public its eighth course of free, popular scientific lectures.

The Lectures will be given on Thursday Evenings at eight o'clock, in Greenwood Hall, south-west corner of Sixth and Vine streets; the use of which has been granted the Society by the courtesy of the Ohio Mechanics Institute.

Cards of admission will be required at the door, and may be obtained of the Secretary of Ohio Mechanics Institute, of Davis L. James, No. 131 West Seventh Street, of George W. Harper, of Mr. Wm. Hubbell Fisher, 13 Wiggins Block, or, at the rooms of the Society, No. 108 Broadway.

The Committee sincerely hopes that the public will show its appreciation of the course by large attendance

Most of the lectures will be illustrated by lantern views and charts, and all will be of a character to interest and instruct non-scientific people.

DAVIS L. JAMES,
GEO. W. HARPER,
WM. HUBBELL FISHER, } *Committee.*

[NOTE.—Mr. Wm. Hubbell Fisher was elected a member of the Committee by the Executive Board after the comp'etion of this programme, in place of Rev. Raphael Benjamin removed to New York City.]

Lectures.—Season of 1889.

January 3d.—Introductory—"The Method of Science."
PROF. EDWARD ORTON, (Ohio State University.)

January 10th.—On Musical Sounds, (by request.)
Illustrated by Lantern projections and experiments.
PROF. THOS. FRENCH, JR., (Cincinnati University.)

January 17th.—No Lecture.

January 24th.—"The Meteorology of Ohio, and the Daily Weather Map."
LT. J. C. WALSHE, (U. S. Signal Service.)

January 31st.—"What are we Eating?"
DR. WALTER S. CHRISTOPHER.

February 7th. -Some Microscopic forms of Vegetable Life.
(Illustrated by Lantern projections.)
GOV. JACOB D. COX, (Cincinnati University.)

February 14th.—"Destruction of the Buffalo and our other Wild Animals."
(With Lantern pictures.)
MR. WM. HUBBELL FISHER.

February 21st.—"Modern Surgery."
DR. JOSEPH RANSOHOFF, (Medical College of Ohio.)

February 28th.—"Ascent of the Matterhorn."
(Illustrated with maps and views.)
PRES. DAVID L. JORDAN, (University of Indiana.)

March 7th.—"The Beautiful and Curious in Insect Life."
(With Lantern views and Blackboard drawings.)
MR. CHAS. DURY.

VOL. XV. NOS. 3 & 4.

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THE JOURNAL

OF THE

Cincinnati Society

OF

Natural History

PUBLISHING COMMITTEE.

GEO. W. HARPER. H. J. BUNTIN.
WM. HUBBELL FISHER. MRS. M. C. MOREHEAD.
DAVIS L. JAMES (Editor).

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Officers of the Society.

PRESIDENT, ... T. B. COLLIE[R]
FIRST VICE-PRESIDENT, . . . DR. F. W. LANGD[ON]

Photographic Section meets
Second and Fourth Mondays, 8 P. M.

Date of publication of this number, February 24, 1893.

An Index to Vol. XV will be furnished with a future number.

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THE JOURNAL

- OF THE -

Cincinnati Society of Natural History.

VOL. XV. · CINCINNATI, OCT., 1892, JAN., 1893 · NOS. 3 & 4.

PROCEEDINGS.

September 6, 1892.

The regular September meeting of the Society was called to order at 8.19 P. M., with President Collier in the chair.

The minutes of June 7 were read and approved.

The application of W. F. Howell, as an acting member, was ordered posted.

Upon motion, the President was instructed to write each of the several persons whose resignations are now before the Society, calling attention to the changes that have been made in the Museum, and urging their reconsideration.

The report of the Committee upon the Death of Dr. Byrnes was read and ordered filed.

Mr. Dury made some remarks upon Albino robins, calling especial attention to their enemies.

A general discussion followed concerning the Albinos of different birds and mammals.

Adjourned.

December 6, 1892.

The regular December meeting of the Society was called to order, with Vice-President Langdon in the chair.

The minutes of September 6 were read and approved.

The applications of Messrs. Charles Barnes and W. A. Eudaly were read and ordered posted.

The reading of the minutes of the Executive Board was postponed.

Mr. Davis L. James read an interesting paper upon the Mango (Magnifera indica), which was followed by a very hearty general discussion.

The following donations were presented and received, to-wit:

From Mr. D. L. James, three Short-Tailed Shrews (Blarina brevicauda).

From R. H. Galbreath, by Dr. O. D. Norton, one Agate and one Turkish Turquois.

DONATIONS.

D. L. James, three Short-Tailed Shrews (B. brevicauda).

R. H. Galbreath, by Dr. O D. Norton, one Agate and one Turkish Turquois.

A. McLaughlin, one Great Horned Owl (Bobo virginianus).

Carlisle Murdock (seven years old), Green Snake Eggs (Liopeltis vernalis).

Donors name unknown, one Silver Lamprey (Ichthyomyzon argenteum).

Seth Hayes, Skull of Dog (Canis familiaris), Skull of Cat (Felis domesticus), Skull of European Swan (Cygnus der), Tongue of European Swan (Cygnus der).

Mrs. B. Van Ham, by Dr. O. D. Norton, one Skull from Florida mound.

EXCHANGES.

American Museum of Natural History, New York City.

American Journal of Science, New Haven, Conn.

American Academy of Arts and Sciences, Boston.

American Naturalist, Philadelphia.

American Philosophical Society, Philadelphia.

American Antiquarian, Mendon, Ill.

American Association for Advancement of Science, Salem, Mass.

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New York State Museum, Albany.
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New Orleans Academy of Sciences.
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Peabody Museum of Arch. and Ethnology, Cambridge, Mass.
Psyche, Cambridge, Mass.
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Rochester Academy of Science, Rochester, N. Y.
St. Louis Academy of Natural Sciences, Mo.
State Historical Society of Wisconsin, Madison.
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Torrey Botanical Club, Columbia College, New York City.
Technical Society of the Pacific Coast, San Francisco.
United States National Museum, Washington.
United States Fish Commission, Washington.
United States Geological Survey, Washington.
United States Naval Observatory, Washington.
University Studies, University of Nebraska, Lincoln.
University of Minnesota, Agricultural Experiment Station, St. Anthony Park, Minn.
University of Iowa, Iowa City.
United States General Weather Service, Washington.
Vassar Brothers' Institute, Poughkeepsie, N. Y.
War Department, Surgeon General's Office, Washington.
Washburn College Laboratory, Topeka, Kas.
Wisconsin Academy of Science, Arts and Letters, Madison.
Wagner Free Institute of Science, Philadelphia.
West American Scientist, San Diego, Cal.
Zoological Society of Philadelphia.

FOREIGN.

Academia Nacional de Ciencias, Cordova, Argentine Republic.
Augsburg Naturhistorischen Verein, Augsburg, Germany.

Argentina Historia Natural, Florentino Ameghino, Buenos Ayres.

Academie des Sciences, Inscriptiones et Belles-lettres, Toulouse, France.

Botanical Society, Edinburgh, Scotland.

Botanischen Verein der Provinz Brandenburg, Berlin.

Braunschweig Verein fur Naturwissenschaft, Braunschweig, Germany.

Bristol Naturalists Society, Bristol, England.

Barcelona Academia de Ciencias y Artes, Barcelona, Spain.

Basel Naturforschenden Gesellschaft, Basel, Switzerland.

Bremen Naturwissenschaftlichen, Bremen, Germany.

Bern Naturforschenden Gesellschaft, Bern, Switzerland.

Belgique Societa Malacologique, Brussels.

Cassel Verein fur Naturkunde, Cassel, Germany.

Canadian Entomologist, London, Ontario.

Canadian Record of Science, Montreal.

Canada Geological and Natural History Survey, Ottawa.

Canadian Institute, Toronto.

Comite Geologique du Russie, St. Petersburg.

Deutschen Gesellschaft fur Natur und Volkerkunde Ostasicens, Yokohama, Tokio.

Deutschen Wissenschaftlichen Verein zu Santiago, Chili.

Deutschen Wissenschaftlichen Verein in Mexico.

Edinburgh Geological Society, Scotland.

Ethnologische Mittheilungen aus Ungam, Budapest, Hungary.

Geological Society of London, England.

India Geological Survey, Calcutta.

India Survey Department, Calcutta.

Italy, Ministero di Agricoltura Industria e Commercio, Rome.

Japan Imperial University, Tokio.

Kaiser Leop-Carol. Deutschen Akademie der Naturforschen, Halle, Prussia.

Kaiser König Geologischen Reichsanstalt, Vienna.

K. K. Naturhistorischen Hofmuseum, Vienna.

Kongl. Vetenskaps Akademiens Forhandlinger, Stockholm.

Kiew, Societe des Naturalistes, Kiew, Russia.

La Societe Botanique Suisse, Geneva, Switzerland.

L'Institute Royal Geologique de la Swede, Stockholm.
Linnean Society, New South Wales.
Leipzig, Verein für Erokunde, Germany.
Manchester Literary and Philosophical Society, England.
Museo Nacional, Rio de Janerio.
Manitoba Historical and Scientific Society, Winnipeg.
Museo Nacional de Mexico, Mexico.
Museo Nacional, Republica de Costa Rica, San Jose.
Naturforschenden Gesellschaft, Zürich.
Natural History Society of Trencsin, Hungary.
Netherland Zoological Society, Leiden, Holland.
Natural History Society, Glasgow, Scotland.
Nova Scotian Institute of Natural Sciences, Halifax.
New South Wales, Department of Mines. Hon. Minister for Mines, Sidney, Australia.
Oberhessiche Gesellschaft für Natur- und Heil-kunde, Giesen.
Ottawa Field Naturalists Club, "Ottawa Naturalist," Canada.
Ontario Entomological Society, London, Ontario.
Royal Society, Edinburgh.
Royal Physical Society, Edinburgh.
Royal Society, New South Wales.
Royal Microscopical Society, London.
Royal Geological Society of Cornwall, Penzance, England.
Royal University of Norway, Christiania.
Royal College of Physicians, Edinburgh.
Revue Internationale de Bibliographie, Beyrouth, Syria.
Royal Society of South Australia, Adelaide.
Societe des Sciences Naturelles, Nantes.
South African Philosophical Society, Cape Town.
Societa Toscana di Scienza Naturali, Pisa, Italy.
Sociedad Mexicana de Historia Natural, City of Mexico.
Societe Imperiale des Naturalistes de Moscow, Moscow, Russia.
Sociedad Cientifica Antonio Alzate, City of Mexico.
Societe Africana d' Italia, Naples.
Societatum Litterae, Frankfort on Oder.
Societe Entomologique de France, Paris.
Schweizerischen Botanischen Gesellschaft, Zürich, Switzerland.

Torino Musei di Zoologia ed Anatomia Comparata, Turin, Italy.

Verein für Vaterlandische Naturkunde in Wurttemburg, Stuttgart, Germany.

Victoria, Public Library, Museum and National Gallery, Melbourne.

Westfalischen Provinzal Verein fur Wissenschaft und Kunst, Munster, Germany.

OBSERVATIONS CONCERNING FORT ANCIENT.

BY SELDEN S. SCOVILLE, M. D., LEBANON, OHIO.

(Paper read by Abstract, at the Rochester Meeting of The American Association for the Advancement of Science, 1892.)

There have been so many articles and maps published descriptive of Fort Ancient, that we shall take it for granted that all are familiar with its situation and general features.

Our remarks will include a description of the ground and water courses at the eastern part of the works, and the character of the high embankments that cross the neck of the peninsula, with observations regarding the purposes of the gate-ways, and also a few thoughts bearing upon the question as to whether all the earth-works seen at Fort Ancient were constructed at the same period of time.

It is to be regretted that no map has ever been published which fully illustrates the topography of the ground at the eastern part of the fort, and that extending to the northeast, on which the two large mounds and long parallel walls are situated. In our description of the ground and water courses, we shall not claim to be strictly accurate, as we have made no regular survey, but we hope to be approximately correct.

The two streams — twin streams we may call them — which pass down, one on either side of the peninsula, on which the fort stands, rise about three-fourths of a mile northeast of the fort. In their upper parts they have excavated quite wide, though not deep beds, in the glacial clays; but before reaching the fort they begin to cut down vigorously into the lower silurian shales and limestone, and soon form large hollows or ravines. A short distance from their sources they diverge and are more widely separated for some distance, but upon approaching the fort come much nearer together, forming what has been known as the neck of the peninsula or plateau, on which the fort proper is situated. They again diverge at

this point, the north stream taking a due west course to reach the Little Miami River; the other a south-west direction to reach the same stream nearly three-fourths of a mile below the mouth of its companion.

At the neck of the peninsula the north stream has formed a ravine fully seventy feet in depth; while the one to the south has acquired a depth of from thirty-five to forty feet. From the brow of the north ravine, in a S. S. W. direction, to the brow of the south ravine, the distance is about sixty-two rods. The direction here indicated is that taken by the line of high embankments in crossing this neck of ground. But the line is by no means straight. To follow its devious course the distance is about seventy-five rods, or thirteen rods greater than a direct line.

On this neck of land, about midway between the large ravines, rises a little stream or branchlet, which runs south, bearing a trifle west to enter the large ravine that lies in this direction. It is only about thirty rods in length, but by the time it reaches the ravine it has excavated a bed fully twenty feet in depth. In the upper part of its course it makes quite a curve to the west.

About eight or ten rods north of the head of this branchlet rises another similar stream, which runs north, bearing a little west, to enter the north ravine. It is from twenty to twenty-five rods in length, and in its course curves somewhat to the east, or in an opposite direction from the one just described. This branchlet, a few yards before it enters the large hollow, is joined by another tiny stream coming down from the southeast. It is only ten or twelve rods in length.

It is proper to state that the two branchlets first described, particularly in their upper parts, are not at this time well defined. The wearing down of the high embankments, which were constructed immediately on their western borders, and the cultivation of the adjacent fields have, in places, almost obliterated them. This is noticeable particularly with the one that enters the north ravine. It is at this time well defined only in its lower part, where it has formed a gully fifteen feet in depth. The construction of the Chillicothe and Lebanon turnpike, which emerges from the Fort here, contributed to its obscurity. A number of years ago we were informed by

an elderly gentleman, who knew the place when covered with the primitive forest, that these streamlets were well defined, and during wet seasons of the year contained quite an amount of running water.

The idea has been advanced that these small streams were at first artificial ditches, formed during the construction of the line of embankments. There is nothing to favor such an idea. In proof of their being natural, and having existed when the fort walls were constructed, we have but to call attention to the singular and devious course the line of embankments takes in crossing the neck of the peninsula. Instead of pursuing a direct course, as undoubtedly would have been the case had these branches not existed, it makes reverse curves, and in shape resembles the letter S, though the curves are not as short or abrupt as seen in this letter. The line of embankments was constructed on the western borders of the streams, and made to conform to their curves, which we have described above. There is evidence that during the building of the walls these streams, in their upper parts, were deepened, in order to afford greater protection to the works, and to obtain material for the embankments.

We are now prepared to say that the narrow piece of ground between the heads of the first branchlets described, and which is only eight or ten rods wide, must be regarded as the true neck of the peninsula on which the fort is situated, and was the only place that an entrance could be effected without encountering natural defenses in the way of branches, ravines and valleys. By viewing the ground immediately outside of the fort, we shall not fail to see that the neck of ground named marks the true divide or water-shed between the large ravines. This can not be determined by observations on the inside of the fort, because here the ground, in order to obtain material for the walls and for other purposes, was leveled off to almost the evenness of a brick yard.

The middle of the Chillicothe and Lebanon road, where it passes between the two large mounds, marks the true water-shed at that point. This is about twenty-two rods east of where the road leaves the fort, and about ten rods further north than the point we have described as the true neck of the peninsula.

The two parallel walls, which form the guarded road-way, as it has often been styled, start off, we know, from the large mounds, and run in a north-east direction for the distance of over half a mile. This guarded-way commences on the true water-shed, and by the direction taken, it is enabled to keep on the divide, thus avoiding the larger streams and their numerous branches.

A careful study of the character of the ground immediately to the north and south of the two large mounds can not fail to throw some light on the nature of the two ditches that are seen here. We will be convinced that they are artificial, and that they were not constructed simply for drainage purposes, as has been frequently suggested. The natural drainage from the mounds is good in both directions; and if it had been desirable to improve this by constructing open sewers, different directions would have been taken, as being more efficient and much less expensive. Especially will this apply to the moat that starts from the mound on the south side of the road. Here the natural course for a drain is toward the southeast, where it could, in a short distance, be made to enter a small ravine. It bears, however, more toward the south on higher ground, and throughout most of its course has less fall than if carried in a different direction.

The directions and positions of these moats at once suggest that they were constructed for defensive or strategic purposes. They could be used as rifle-pits, or more properly bow-pits; and, besides, would serve as passways to enable persons to enter the guarded roadway from the large ravines unobserved. Warriors from the villages in the river bottoms, by means of the large ravines, these moats and the guarded-way, could pass entirely unobserved to the high ground northeast of the fort, which would make a distance of fully a mile and a quarter.

The guarded-way, we have said, is over half a mile in length. Its direction from the large mounds is generally given as northeast. Its true bearing, however, is a few degrees further toward the east. Whatever may have been the real object in constructing this long passway, it seems to have been necessary that it should reach the high ground east of the fort. This could have been accomplished in about

half the distance by taking a south-east direction. And to have gone directly east would have shortened the distance nearly one-third. But neither of these routes was practicable, on account of the valleys and streams that lie in these directions. The only practical route was the one taken. Had the builders varied the direction either way, to the extent of only three or four degrees, the heads of several little streams would have been encountered.

The high ground referred to consists of a wide ridge, with an elevation above the ground at the fort of thirty-five or forty feet. From this ridge a view could be had in every direction for at least eight or ten miles, provided the country was devoid of timber, which was probably the case, except along the larger water courses.

While the real object in constructing this guarded-way is in great doubt, we can see how it might have been of great service in times of danger. The little mound that stands in the farther end, on the high ground, could be used as an observatory, or as a place from which to make signals, either by flags, fire or smoke, to the surrounding villages belonging to the Fort Ancient nation. A strong out-post, if necessary, could be maintained in the expanded end of the road-way which encloses the mound. Large forces could be thrown out into the road-way to harrass the flanks of an advancing foe.

All the indications tend to show that this guarded roadway was constructed for military purposes. And it is quite certain that the enemy most dreaded by the inhabitants in and about Fort Ancient were a people inhabiting the country to the northeast.

Our attention will now be directed to the line of high embankments which crosses the neck of the peninsula from one large ravine to the other. This is divided by the openings or gate-ways into six sections. Their length on top varies from about seventy-five to a hundred and fifty-seven feet. The seven gate-ways have a top width of from fifty to seventy-seven feet. The perpendicular height of the embankments varies from seventeen to twenty-two feet. These sections of wall, taken collectively, form two curves, as we have illustrated. But taken separately, they are found to be perfectly

straight. It will be seen, then, that the turns or changes in direction take place at the openings or gate-ways. This arrangement exhibits quite a high degree of engineering skill. By adopting this plan, the sections of wall could be built straight, thus saving much labor.

The third section of wall, south of the north ravine, and which stands immediately south of the Chillicothe and Lebanon road, has the greatest elevation, which is twenty-two feet. It has a top-length of seventy-eight feet and a width of base of seventy-four feet. The angle of slope of sides is about thirty-six degrees. Its summit, though well rounded off, is quite massive, so that by a very little leveling down, it would be sufficiently wide to accommodate a standard-gauge railway. In all respects, except in size and length, this section of wall does not differ materially from the others.

A person standing some distance to the west, on the inside of the fort, will be surprised at the evenness of the summits of this and the next two much longer sections of embankments that extend to the south. And he will be more surprised when he notices how closely their tops range with each other, and at the almost exact horizontal line which is thus formed against the eastern sky. The straightness of this line is slightly marred by a downward curve of from eight to ten inches in the top of the section next to the road, caused, doubtless, by water standing at its base on the outside of the fort. This has affected the ground beneath the middle of the wall, causing it to settle.

This accurate summit-range is the more remarkable, when we consider that these sections of wall vary considerably in height, as measured from the surface of the ground. We must conclude that this accurate top-range was intentional on the part of the builders, and that the reason of its remaining unchanged is owing to the fact that the height of the embankments has been but very little affected since their construction. If these sections of wall had been carried up to a considerable distance above their present elevation, and to quite a narrow ridge, as many suppose, and then worn down by natural agencies to the height we now find them, there would be no such accurate summit-range. The extent of wearing of the different sections would not be the same. And it would

be very strange if the top of each section did not present a very uneven appearance.

From our frequent visits to Fort Ancient, and a careful study of these high embankments, we can come to no other conclusion than that when first constructed they had flat summits, and that their elevation, as we have endeavored to show, was never but slightly greater than at present.

At a number of the openings in the embankments of the fort, we can ascertain the original width of base of the walls by finding stones which were evidently used to retain the first earth placed in the embankment by the builders.

Some twenty-five years ago, when visiting the fort, I discovered that there had been considerable earth removed from the end near the ground of the high section of embankment, next to the Chillicothe and Lebanon road. The object was to widen the passage of this thoroughfare. By an examination of the excavation, I discovered stones placed in such positions as to clearly indicate the original width of base of the embankment. This, as near as I could measure at the time, was found to be fifty-four feet. About ten feet of earth on either side of the embankment lay outside of these little retaining walls, and which had been washed down since the earth-wall was first constructed. This section of embankment, it will be remembered, has at the present time a ground-width of seventy-four feet.

The question now arises as to where the earth that has been carried down since the embankment was constructed came from. Certainly not from off the very top or center of the wall, if we concede that there has been no great change in its height. It must have come chiefly from the sides at or near the top. If the top of the wall was flat, as we have claimed, the first and important wear would be upon the angles, and not until these were well worn off would the center of the embankment be much affected.

By estimating the amount of earth that lies on either side of the walls, outside of their original bases, we may form some idea of not only the original top-width of these embankments, but the angle of slope of their sides. In our reconstruction of these high embankments, we would give them the form of an elongated truncated pyramid. Taking the

highest section, or that which stands immediately south of the road, we would say that its original height was twenty-four feet, or two feet higher than at present. The decrease in elevation we would attribute in part to settling of the wall. The width of base was fifty-four feet, as before stated. Width of summit, somewhere between fifteen and twenty feet. Slope of sides, fifty or fifty-five degrees.

We think it highly probable that all of the enclosing walls of Fort Ancient had flat or level summits. But it was at the north-eastern part of the fort where such a form of embankment was most needed. Here was the place of greatest danger. It has been the custom in all ages of the world for the inhabitants of a walled town or city, when the place was attacked, to make their defense principally from the tops of the walls. And it was often necessary to have room for quite a large force, in order to repel the assaults of the enemy. Now, we can not suppose that the inhabitants of Fort Ancient formed an exception to this mode of defensive warfare.

There is evidence that the north-eastern part of the fort was set apart as a place of assembly, whether for civil, religious, social or military purposes, we can not, of course, positively determine. But we believe that it was used as a military camp, or at least as a place of general rally of the warriors in times of danger. Here are a number of acres that have been smoothed off very evenly. The portion of this level area adjoining the high embankments presents a most remarkable evenness of surface. To fully appreciate this a person should view it from the road just inside of the fort.

All indications go to show that the north-east part of the fort was regarded by the inhabitants as the point of greatest danger. Hence this military *campus*, and the massive walls with wide summits, ready to be mounted with files of hardy warriors, armed with bow and battle-ax, whenever the fort was in danger of being assaulted.

In this connection we will refer briefly to the earth-work in the northern part of the fort, known as the crescent or semicircle. It is 270 feet long, about sixteen feet wide at base and not over two feet high. From a careful study of its character, location and immediate surroundings, we have come to regard it as the remains of a complete circle that once

existed here, the diameter of which was about 280 feet. Like nearly all circular earth-works, it probably had but one opening or gate-way, and this is still plainly visible near the center of the portion remaining. It is twenty-four feet wide, and looks to the northwest. This opening is so distinct that we have been surprised by not seeing it mentioned by any of the writers on Fort Ancient who have spoken of this crescent.

Assuming that our opinion concerning this earth-work is correct, a little more than two-thirds of the circle which lay to the southeast has been removed; and, as we believe, by the builders of the fort, in order to extend the area of level ground, to which reference has been made. The material was used either in the construction of the large investing embankments, or in filling up the head of a ravine that is seen a short distance south of the road. There is evidence that the heads of several small ravines were filled in preparing this level piece of ground.

The gate-ways of Fort Ancient. The first one south of the Chillicothe and Lebanon road, in the line of high embankments, was, doubtless, the grand entrance for this part of the fort. It is situated at the true neck of the peninsula which we have described. It had, when first constructed, a top-width of probably sixty feet, and a ground-width of from twenty to twenty-six feet. Situated on the inside of the fort, and extending a short distance into the gate-way, there was a parapet, most likely circular in form, with an elevation but little more than one-fourth that of the embankments. The remains of this parapet are easily recognized.

There are, we know, over seventy artificial openings or gate-ways in the enclosing wall of the fort. The presence of so many is a puzzling question, in view of the quite positive evidence that the works were constructed for defensive purposes. There are fully as many, if not more, at places where the builders apprehended danger, as elsewhere. We have an illustration of this at the north-eastern part of the fort. At all points, where the works could be more easily approached by an enemy, the walls were made higher. But in no instance was the number of gate-ways lessened.

Shall we conclude that there was something strategic in the design of these openings? Did they serve as places where

the besieged could make sallies and retreats, in order to draw the enemy within the enclosure to be captured? We know that almost all barbarous, or semi-civilized people, regard the capture of their enemies of as much or more importance as killing them in battle.

While these openings may have served the purpose here indicated, the weight of evidence seems to favor the idea that they were designed to afford ready means of egress and ingress for the inhabitants of the place and surrounding country, the same as we find with all walled town or cities in both ancient and modern times. Probably they were furnished with means of closure, but no evidence of such provision has as yet been discovered. However, no thorough exploration of these passages has ever been made. They are generally filled with two or three feet of earth that has been carried down from the ends of the walls.

It appears somewhat strange that nearly all the earth-works in Ohio and elsewhere in the Mississippi valley, which afford positive evidence of having been constructed for defensive purposes, have numerous openings or gate-ways. While those suspected of having a ceremonial or symbolic signification, have, as a rule, very few. The circular ones generally have but a single opening.

Most likely, if we could know all the circumstances under which these old works at Fort Ancient were constructed, we would have a better idea of the purposes of the openings. The three and a-half miles of massive walls were not planned and constructed under circumstances of immediate danger. Evidence of cool deliberation and wise calculation is stamped on every feature of the works. Perhaps few modern engineers could show greater skill in constructing earth-works than that exhibited by the old Mound Builders at Fort Ancient.

The indications, we think, favor the idea that when the building of the heavy enclosing walls was first contemplated, the circumstances surrounding the people had greatly changed. While pressing emergencies did not actually exist, they were discerned in the near future — probably the long and relentless struggle for supremacy in the Mississippi Valley, between the Short Heads from the South, and the more barbarous Long Heads from the North, had already assumed a very

serious aspect, and it was thought necessary to fortify by building a Chinese wall (?) around the town. Not, perhaps, to protect simply the town itself, but to afford a place of refuge for the inhabitants of the surrounding country in times of great peril. But why do we associate the investing line of embankments at Fort Ancient with a defensive work of the Orientals by calling it a Chinese wall? The answer to this question, we trust, will be found in the following brief remarks:

We shall not be much at variance with eminent authority on archæology by saying that there are strong grounds for the belief that in very early times there appeared in the great Mississippi Valley, as occupants of the country, people representing the two leading branches of the great Mongolian family of Eastern Asia. There were the wild North American Indians, who came from the old Chinese Tartars, and who, it is to be presumed, found their way into the New World by the way of Behring Straits. The other adventurers were a less barbarous people, and came from the more enlightened Chinese. At a time long ago, they drifted from their home in the East across the Pacific into Central America, or Yucatan, and finally, by the extension of their civilization northward, reached the Mississippi Valley.

We know something of the hostilities that existed in the East between these Mongolian branches, and that it was thought necessary on the part of the more civilized people to build a great wall 1,200 miles in length, as a defense against their wild and ferocious brethren.

Here in the Mississippi Valley, by the same Mongolian blood, was engendered a similar strife for supremacy; and defensive works, such as we see at Fort Ancient, were ultimately constructed by the more civilized party to the warfare. But the results of fortifying, it would seem, were not as successful as in the case of the Celestials in the East.

There is, we think, unmistakable evidence that the large earth-works constructed on sites strongly fortified by nature, such as we see at Fort Ancient, mark the beginning of the end of the old Mound Builder civilization, at least so far as regards the Ohio Valley. The last permanent occupants, and perhaps the builders of the fort, were, most likely, the people

whose remains are found in rude stone cists in the embankments, and in other places, particularly in the river bottoms. Their bones are much better preserved than those found in the mounds about the fort, notwithstanding the conditions of sepulture were very unfavorable for the preservation of human remains.

There is no question but that there is a vast difference in the age of the earth-works in Ohio and elsewhere in the Mississippi Valley. And we are of the opinion that there is quite a differance in the age of those seen at Fort Ancient. There are indications that the parallel walls, the different mounds, the crescent, and perhaps the two moats, were constructed long before the heavy enclosing walls. When these minor works were first seen by the white settlers, they were much more worn than any portion of the investing walls. Before the land was cleared and cultivated, the parallel walls were so flattened down as to very much resemble ordinary road-beds. The early settlers always spoke of them as roadways. The crescent, although it has never been disturbed by plow or harrow, is much worn down, and so smoothly and compactly blended, as it were, with the natural ground, that the casual observer would hardly suspect that it was artificial. It has every indication of being much older than the large embankments. We have already indicated that it existed when the Fort proper was built.

There can be but little doubt that the peninsula, on which the fort stands, was occupied by the Mound Builders long before it was invested with high walls. And if our opinion is correct, the artificial defenses consisted of the long guarded-way, probably the two moats, and the contiguous mounds. These works, however, partook largely of a strategic character, and were not designed wholly for the protection of the dwellers on the peninsula, but for the inhabitants of the surrounding villages as well. There were at least two of these old-time villages in the river bottom near the fort. Their sites are now three feet or more below the surface of the ground.

MORDELLIDÆ IN THE VICINITY OF CINCINNATI, OHIO.

BY CHARLES DURY.

The *Mordellidæ*, as collected by most collectors (if taken by them at all, which is seldom the case), are so poorly handled that they are almost worthless for study. Many of those which I have received have been almost buried in glue, thereby obscuring the characteristic markings; when an attempt is made to clean them they fall to pieces. During the Summer of 1892, I devoted much of the season to this family, with gratifying success. The locality seems to be very rich. Some of them occur in prodigious numbers. Imperfect and denuded specimens give but a poor idea of the beauty of these nimble little insects when fresh, and with their pubescence perfect. They should always be collected in a cyanide bottle, and kept dry and perfectly clean. None of the family should ever be pinned, but always mounted on triangles of thin card board. They are quite difficult to mount, owing to their narrow, flattened form, and the glue should be thick and quick setting to hold them in an upright position on the triangle until dry. Use a very small quantity of glue, too much obscures characters. The posterior legs in *Mordellistena* should be drawn out behind to better exhibit the ridges on tibia and tarsi, which seem to be such an excellent specific character. A strong glass and good light are necessary to properly study these ridges. The excellent synopsis of the family by John B. Smith (Trans. Amer. Ent. Soc., July, 1882,) leaves little to be desired. While many of the species occur abundantly on blossoms, I get some of the rarest and most interesting by sweeping weeds growing in the woods with a sweep net. Early morning and late in the afternoon are the best times to secure them, for during the heat of mid-day they are so active jumping around in the net or umbrella, and flying away so

quickly, that it is very difficult to get them into a bottle. With us the first individuals of the family appear about the middle of May, and reach their maximum numbers during June, but by the middle of July most of them have gone. I give below notes on some of the species, and also a list of them, which may assist in throwing a little light on geographical distribution:

PENTARIA.

trifasciata Mels., common, taken abundantly on the foliage of an osage orange hedge, June.

ANASPIS.

rufa Say, common.

TOMOXIA.

bidentata Say, common.
linella Lec, common.
hilaris (Say), rare.

The three species above are found about dead beech timber, but with the destruction of the trees the beetles have become scarce.

MORDELLA.

melæna Germ., rare.
scutellaris Fab., common.
octopunctata Fab., common.
marginata Melsh., common.
lunulata Hel., rare.
serval Say, abundant; always found resting on the underside of logs, mostly beech.
oculata Say, abundant.
triloba (Say), abundant.
undulata Mels., rare.
discoidea Mels., not common.

GLIPODES.

sericans Mels., rare.

MORDELLISTENA.

bicinctella Lec., rare; a very variable species both in size and markings. In one the thorax is entirely black; in another there is a dark basal cloud; in another the thorax is very pale. The width of elytral bands is also variable.

arida Lec., rare.

lutea Mèlsh., common.

trifasciata Say, rare.

lepidula Say, rare.

limbalis Melsh., not rare.

biplagiata Helm,, an abundant species, and the first that appears in the Spring (May), occurring on blossoms of the "Haw" (Viburnum).

decorella Lec., rare.

bipustulata Hel., rare.

picipennis Smith, rare.

fulvicollis Melsh, rare.

militaris, Lec., rare.

comata Lec., common.

aspersa Mels., rare.

tosta Lec., abundant.

amica Lec., rare.

infima Lec., rare.

varians Lec., common.

gramica Lec., common.

ustulata Lec , common.

My series point to the conclusion that the three above are color varieties.

semiusta Say, rare.

nigricans Mels., rare.

pustulata Mels., abundant.

convicta Lec., not rare.

splendens Smith. I have a specimen which I think is this species, but it differs from the type in having one ridge less on the first joint of tibia. When fresh, was of a sage-green color, but in drying has faded to pale silvery. A very pretty species.

morula Lec., rare.

ambusta Lec., common.

unicolor Lec., with pustulata, our most abundant species.
marginalis Say, common.
pubescens Fab., common.
bihamata Mels., common. This species is exceedingly active, jumping about in the net like a flea. M. discolor resembles it superficially, but is not nearly so active.
liturata Mels., common.
fuscata Mels., common.
suturella Helm., one specimen.
attenuata Say, one specimen.
discolor Mels., two specimens.
æmula Lec., one specimen (teste Horn).

In addition to the fifty-three species enumerated above, I have several *Mordellistena* which I think are new; one of them is near the Californian *vilis*, Lec. I hesitate to describe them, as there seems to be too many species now.

AVONDALE, January 6, 1893.

THE MYXOMYCETES OF THE MIAMI VALLEY, OHIO.

BY A. P. MORGAN.

First Paper.

(Read January 3, 1893.)

MYXOMYCETES, Wallr.

Fructification essentially a minute membranaceous vesicle, the SPORANGIUM inclosing the SPORES, the product of a motile protoplasmic body called the PLASMODIUM.

Microscopic organisms with the habit of the Fungi. The ripe spore of the Myxomycetes is globose or ellipsoidal in shape, with the epispore colorless or colored, and smooth or marked by characteristic surface — sculpture according to the species; the spore in germination gives rise to an elongated protoplasmic body, which exhibits amoeboid movements, and is known by the name of *swarm-cell*. The swarm-cells multiply by bipartition, which may be repeated through several

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PRESTON, HAMILTON COUNTY, OHIO, December 28, 1892.

MR. DAVIS L. JAMES:

Dear Sir — Along with this I send you the first installment of the papers, entitled "The Myxomycetes of the Miami Valley, Ohio."

The work in these papers is based upon my ample collection of Myxomycetes growing in this region, comprising more than one hundred species; these have been diligently compared with specimens obtained from correspondents elsewhere in this country and in Europe.

At the same time, I have also included many extrr-limital species. This has been done chiefly to more clearly elucidate the subject in places where the local material is not sufficient.

The only apology I can make for the arrangement which I present, is that I have been obliged to choose from several different systems. I have aimed not to hamper myself, by attaching paramount importance to some particular character throughout.

I purpose to furnish a synopsis of the whole at the end of the work.

Very truly yours, A. P. MORGAN.

generations; they then unite together to form the large motile protoplasmic bodies named *plasmodia*. The newly-formed plasmodium is distinguished by its greater size from the swarm-cells, while it exhibits essentially the same movements and changes of shape. The plasmodia gradually increase in size, and as they grow assume commonly the form of branched strands; these spread over the surface of the substratum, which is usually the decaying parts of plants, in the form of veins and net-works of veins, giving rise to a copiously-branched reticulated or frill-like expansion, which covers surfaces varying in extent from a few to several centimeters. They are chiefly composed of a soft protoplasm of the consistence of cream, which may be readily spread out into a shapeless smear, and is usually colorless, but sometimes exhibits brilliant colors of yellow, orange, rose, purple, etc. The development of the plasmodium ceases with the formation of the *spores* within their *sporangia*.

The formation of the sporangia out of the plasmodium appears under three general forms, which, however, pass into each other and are, therefore, not strictly limited.

First: An entire plasmodium spread out on its substratum becomes transformed into a sporangium, or it divides into a variable number of unequal and irregular pieces, each of which undergoes transformation. Such a sporangium lying flat on the substratum, more or less elongated and flexuous, often branched and reticulate, is termed a *plasmodiocarp*.

Second: Erect sporangia on a narrow or stalk-like base, begin as node-like swellings on the branches of the plasmodium, and gradually rise to their ultimate form as the surrounding protoplasm flows into them and assumes an upward direction. These sporangia are nearly always perfectly regular in shape; they may be globose, obovoid, somewhat depressed, or more or less elongated, and are either stipitate or sessile.

Third: A number of plasmodia collect together from every side and become fused into a single body, often of considerable dimensions; from these combinations originate the large spore-receptacles which are called *æthalia*. The component sporangia may be regular in shape, standing close together, in a single stratum, with entire connate walls; more

often, being elongated and flexuous, they branch and anastomose freely, their walls becoming perforated and more or less defective; in other cases, the æthalium is a compound plasmodiocarp, the narrow sinuous sporangia branched and anastomosing in all directions, forming an intricate network, closely packed together and inseparable. The surface of the æthalium is often covered by a continuous layer of some excreted substance, which is called the *common cortex.*

The wall of the sporangium, typically, is a thin, firm membrane, colorless and pellucid, or colored in various shades of violet, brown, yellow, etc.; it is sometimes extremely delicate, as in Lamproderma, or is scarcely evident, as in Stemonitis; in other instances it is thickened by deposits on the inner surface, as in Tubulina, or by incrustations on the outer surface, as in Chondrioderma. The stipes are tubes usually with a thick wall, which is often wrinkled and folded lengthwise, and is confluent above with the wall of the sporangium; in some cases the stipe also enters the sporangium, and is more or less prolonged within it as a *columella.* The stipe commonly expands at the base into a membrane, which fastens it to the substratum, and is called the *hypothallus;* when all the stipes of the same group of sporangia stand upon a single continuous membrane, it is called a *common hypothallus.*

In the simplest forms, the cavity of the sporangium is filled exclusively with the numerous spores; but in most all of the genera, tubules or threads of different forms occur among the spores and constitute the *capillitium.* The capillitium first makes its appearance in Reticularia, in which upon the inner surface of the walls of the sporangia there are abundant fibrous thickenings; next in Cribraria it is spread over the inner surface of the wall, and is early separated from it; here, also, it first assumes a more definite form and arrangement; in Physarum it is in connection with the wall of the sporangium only by its extremities while it traverses the interior with a complicated network; in Stemonitis and its allies the capillitium originates wholly from the columella; in most species of Arcyria it issues from the interior of the stipe. The capillitium in Trichia consists of numerous slender threads which are *free,* that is, are not attached in any way; they are usually simple and pointed at each extremity; the surface of these threads exhibits beautiful spiral markings.

ORDER I. LICEACEÆ.

Sporangia always sessile, simple and regular or plasmodiocarp, sometimes united into an æthalium. The wall a thin, firm, persistent membrane, often granulose-thickened, usually rupturing irregularly. Spores globose, usually some shade of umber or olivaceous, rarely violaceous.

The species of this order are the simplest of the Myxomycetes; the sporangium, with a firm, persistent wall contains only the spores. There is no trace of a capillitium, unless a few occasional threads in the wall of Tubulina prefigure such a structure. To the genera of this order is appended the anomalous genus Lycogala, which seems to me better placed here than elsewhere.

TABLE OF GENERA OF LICEACEÆ.

1. LICEA. Sporangia simple and regular or plasmodiocarp, gregarious; hypothallus none.
2. TUBULINA. Sporangia cylindric, or by mutual pressure becoming prismatic, distinct or more or less connate and æthalioid, seated upon a common hypothallus.
3. LYCOGOLA. Æthalium with a firm membranaceous wall; from the inner surface of the wall proceed numerous slender tubules, which are intermingled with the spores.

I. LICEA, Schrad. Sporangia sessile, simple and regular or plasmodiocarp, gregarious, close or scattered; hypothallus none; the wall a thin, firm membrane, sometimes thickened with scales or granules, breaking up irregularly and falling away or dehiscent in a regular manner. Spores globose, variously colored.

The sporangia are not seated on a common hypothallus; they are, consequently, more or less irregularly scattered about on the substratum.

1. LICEA VARIABILIS, Schrad. Plasmodiocarp not much elongated, usually scattered, sometimes closer and confluent, somewhat depressed, the surface uneven or a little roughened and not shining, reddish-brown or blackish in color; the wall a thin, firm pellucid membrane, covered by a dense outer layer of thick brown or blackish scales, rupturing irregularly. Spores in mass pale ochraceous, globose or oval, even or nearly so, 13–16 mic. in diameter.

Growing on old wood. Plasmodiocarp 1–1.5 mm. in length, though sometimes confluent and longer. The wall is thick and rough, not at all shining. It is evidently the species of Schweinitz referred to by Fries under this name.

2. LICEA LINDHEIMERI, Berk. Sporangia sessile, regular, globose, gregarious, scattered or sometimes crowded, dark bay in color, smooth and shining; the wall a thin membrane with a yellow-brown outer layer, opaque, rupturing irregularly. Spores in mass bright bay, globose, minutely warted, opaque, 5–6 mic. in diameter.

Growing on herbaceous stems sent from Texas. Sporangia about .4 mm. in diameter. The bright bay mass of spores within will serve to distinguish the species. The thin brown wall appears dark bay with the inclosed spores.

3. LICEA BIFORIS, Morgan, n. sp. Sporangia regular, compressed, sessile on a narrow base, gregarious; the wall thin, firm, smooth, yellow-brown in color and nearly opaque, with minute scattered granules on the inner surface, at maturity opening along the upper edge into two equal parts, which remain persistent by the base. Spores yellow-brown in mass, globose or oval, even, 9–12 mic. in diameter. See Plate III, Fig. 1.

Growing on the inside bark of Liriodendron. Sporangia .25–.40 mm. in length, shaped exactly like a bivalve shell and opening in a similar manner. I have also received specimens of this curious species from Prof. J. Dearness, London, Canada.

4. LICEA PUSILLA, Schrad. Sporangia regular, sessile, hemispheric, the base depressed, gregarious, chestnut-brown, shining; the wall thin, smooth, dark-colored and nearly opaque, dehiscent at the apex into regular segments. Spores in the mass blackish-brown, globose, even, 16–18 mic. in diameter.

Growing on old wood, Sporangium about 1 mm. in diameter. On account of the color of the spores the genus *Protoderma* was created for this species by Rostafinski. It is number 2,316 of Schweinitz's N. A. Fungi.

II. TUBULINA. Pers. Sporangia cylindric, or by mutual pressure becoming prismatic, distinct or more or less connate and æthalioid, the apex convex, seated upon a common hypothallus; the wall a thin membrane, minutely granulose, firm and quite persistent, gradually breaking away from the apex downward. Spores abundant, globose, umber or olivaceous.

The sporangia usually stand erect in a single stratum, with their walls separate or grown together: in the more compact æthalioid forms, however, the sporangia, becoming elongated and flexuous, pass upward and outward in various directions, branching and anastomosing freely. See Plate III, Figs. 2, 3, 4.

1. TUBULINA CYLINDRICA, Bull. Sporangia cylindric, more or less elongated, closely crowded, distinct or connate, pale umber to rusty-brown in color, seated on a well developed hypothallus; the wall thin, firm, with minute veins and granules, semi-opaque, pale umber, often iridescent. Spores in mass pale umber to rusty-brown, globose, most of the surface reticulate, 6–8 mic. in diameter.

Growing on old wood, mosses, etc. Æthalium circular or irregular in shape, from one to several centimeters in extent, the individual sporangia 2–4 mm. in height. Plasmodium at first milky-white, soon changing to bright red, then to umber, becoming paler when mature and dry.

2. TUBULINA CASPARYI, Rost. Sporangia more or less elongated, closely crowded and prismatic, connate, pale umber to brown in color, seated on a conspicuous hypothallus; the wall thin, firm, minutely granulose, semi-opaque, pale umber, iridescent when well matured; all or many of the sporangia traversed by a central columella, from which a few narrow bands of the membrane stretch to the adjacent walls. Spores in the mass pale umber to brown, globose, the surface reticulate, 7–9 mic. in diameter.

Growing on old prostrate trunks. Æthalium two or three to several centimeters in extent, the individual sporangia 3–5

mm. in height. Plasmodium white, the immature sporangia dull-gray tinged with sienna color. The columella, with its radiating bits of membrane, is the same substance as the wall; it may be a reëntrant edge of the prismatic sporangium, caused by excessive crowding together; at least, this may be regarded as its origin; there may have arisen some further adaptation. The species is *Siphoptychium Casparyi*, Rost. I am indebted to Dr. George A. Rex for the specimens I have examined.

3. TUBULINA CÆSPITOSA, Peck. Sporangia short-cylindric, closely crowded, distinct or connate, argillaceous olive to olive-brown in color, seated on a well-developed hypothallus; the wall a thin membrane, with a dense layer of minute dark-colored round granules on the inner surface. Spores argillaceous olive in the mass, globose, minutely warted, 6–8 mic. in diameter.

Growing on old wood. Æthalium in irregular patches sometimes several centimeters in extent, the single sporangia about 1 mm. in height. Plasmodium dark olivaceous, the sporangia blackish if dried when immature, taking a paler shade of olivaceous, according to development and maturity. This is *Perichæna cæspitosa*, Peck. in the 31st N. Y. Report.

III. LYCOGALA. Mich. Æthalium with a firm membranaceous wall; from the inner surface of the wall proceed numerous slender tubules, which are intermingled with the spores. The material of the wall appears under three different forms: the inner layer is a thin membrane, uniform in structure, of a yellow-brown color, and semi-pellucid; the outer layer consists of large flat roundish or irregular vesicles, brown in color, filled with minute granules, and arranged in one or more strata; from these vesicles originate the tubules, which traverse the wall for a certain distance, and then enter the interior among the spores; the tubules are more or less compressed, simple or branched, and the surface is ornamented with warts and ridges, which sometimes form irregular rings and reticulations.

If the sporophores in this genus be regarded as simple sporangia, which is the view that Rostafinski takes of one of

the species, the tubules are simply the peculiar threads of a capillitium. If, however, the æthalium is a compound plasmodiocarp, the tubules stand for the original plasmodial strands and, consequently, represent the component sporangia.

1. LYCOGALA CONICUM. Pers. Æthalia small, ovoid-conic, gregarious, sometimes close together with the bases confluent, the surface pale umber or olivaceous marked with short brown lines, regularly dehiscent at the apex. The wall thin; the outer layer not continuous, the irregular brown vesicles disposed in angular patches and elongated bands, which have a somewhat reticulate arrangement. The tubules appear as a thin stratum upon the inner membrane; they do not branch, and they send long slender simple extremities inward among the spores. Spores in mass pale ochraceous, globose, minutely warted, 5–6 mic. in diameter. See Plate III, Fig. 5.

Growing on old wood. Æthalium 2–5 mm. in height, the tubules 3–8 mic. in thickness. This is *Dermodium conicum* of Rostafinski's monograph, but the structure is essentially the same as in the other species. Massee evidently did not have specimens of this species. I have never seen any branching of the tubules either in the wall or in the free extremities of the interior.

2. LYCOGALA EXIGUUM, Morg. n. sp. Æthalia small, globose, gregarious, the surface dark brown or blackish, minutely scaly, irregularly dehiscent. The wall thin; the vesicles with a dark polygonal outline, disposed in thin irregular reticulate patches, which are more or less confluent. The tubules appear as an interwoven fibrous stratum upon the inner membrane; they send long slender branched extremities inward among the spores. Spores in mass pale ochraceous, globose, nearly smooth, 5–6 mic. in diameter. See Plate III, Fig. 6.

Growing on old wood. Æthalium 2–5 mm. in diameter, the threads 2–10 mic. in thickness, with very slight thickenings of the membrane. The polygonal vesicles give a reticulate appearance to the dark-brown patches which ornament the surface of the wall.

3. LYCOGALA EPIDENDRUM, Buxb. Æthalia sub-globose,

gregarious, sometimes closely crowded and irregular, the surface umber, brown or olivaceous, minutely warted, at length, irregularly dehiscent at or about the apex. The wall thick, the brown vesicles loosely aggregated and densely agglutinated together, traversed in all directions by the much-branched tubules, which send long-branched extremities inward among the spores; the main branches thick and flat, with wide expansions, especially at the angles, the ultimate branchlets more slender and obtuse at the apex. Spores in the mass from pale to reddish ochre, globose, minutely warted, 5–6 mic. in diameter. See Plate III, Fig. 7.

Growing on old wood. Æthalium 5–12 mm. in diameter, the width of the tubules varying from 12–25 mic. in the main branches, with broader expansions at the angles, to 6–12 mic. in the more slender final branchlets. This is one of the most common of the Myxomycetes; it grows in all countries, and in this region may be found on old trunks at all seasons of the year.

4. LYCOGALA FLAVOFUSCUM, Ehr. Æthalia large, subglobose or somewhat pulvinate, solitary or gregarious, the surface at first silvery-shining, becoming yellow-brown, minutely areolate, irregularly dehiscent. The wall very thick and firm, hard and rigid; the thick outer layer of roundish brown vesicles closely compacted in numerous strata; from the vesicles of the lower strata the long and broad much-branched tubules proceed into the interior among the spores; the ultimate branchlets clavate and obtuse at the apex. Spores in the mass pale ochre, cinerous or brownish, globose, minutely warted, 5–6 mic. in diameter. See Plate III, Figs. 8, 9.

Growing on old trunks. Æthalium 1 to several centimeters in diameter, the width of the tubules varying from 25–60 mic. in the main branches, with sometimes much broader expansions at the angles, to 10–25 mic. in the ultimate branchlets. The brown vesicles of the outer wall are easily separated from each other and emptied of their contents by maceration; it is then seen that a thin pellucid membrane incloses numerous roundish granules, much resembling the spores, but usually a little larger, 5–8 mic. in diameter.

ORDER II.—RETICULARIACEÆ.

Sporangia simple, regular and stipitate, or compound, forming an æthalium; the wall a thin membrane with distinct fibrous thickenings upon the inner surface, the membrane, or at least certain portions of it, disappearing usually at the maturity of the spores, leaving behind the more permanent fibrous thickenings as a more or less definite capillitium. Spores globose, purple, brown, ochraceous, rarely violaceous.

In this order the threads of a capillitium first make their appearance; but they are confined to the inner surface of the wall of the sporangium, being set at liberty by the early decay of the outer membrane.

TABLE OF GENERA OF RETICULARIACEÆ.

a. Æthalia.

1. RETICULARIA. Æthalium composed of numerous slender sinuous sporangia which repeatedly branch and anastomose.
2. CLATHROPTYCHIUM. Æthalium composed of numerous regular erect sporangia.

b. Sporangia simple.

3. CRIBRARIA. Capillitium of slender threads combined into a network of polygonal meshes.
4. DICTYDIUM. Capillitium of numerous convergent ribs, which extend from base to apex, and are united by fine transverse fibers, thus forming a network of rectangular meshes.

I. RETICULARIA, Bull. Æthalium composed of numerous slender sinuous sporangia, which repeatedly branch and anastomose, closely packed together and seated upon a com-

mon hypothallus, the apices of the final branches coherent at the surface, and naked or covered by an additional corticate layer. Walls of the sporangia consisting of a thin membrane, with abundant fibrous thickenings, presenting broad expansions, narrowing to thin flat bands, and reduced in many places to slender fibrous threads. Spores abundant, globose, umber or violaceous.

After the maturity of the spores disintegration of the sporangial wall begins, the thin membrane disappearing more rapidly than the fibrous thickenings or the portions of the sporangial walls near the base, which are more compactly grown together; there is thus left at each stage an increasing number of the shreddy fibers mingled with the spores.

1. RETICULARIA SPLENDENS, Morg. n. sp. Æthalium pulvinate, circular or more or less elongated and irregular, seated on a conspicuous silvery hypothallus; the surface naked, bright umber, smooth and shining. Walls of the sporangia firm and quite persistent, pale umber, slowly disintegrating, consisting for the most part of wide expansions, with their angles tapering to narrow bands and slender threads. Spores in the mass pale umber, globose, most of the surface reticulate, 7–9 mic. in diameter. See Plate III, Fig. 10.

Growing on old wood. Æthalium from 1 to several centimeters in extent and 5–10 mm. in thickness, usually growing singly, rarely close enough to be confluent. This species has lately been referred to *Reticularia rozeana*, Rost., but it varies greatly from the account given of that species in the Journal of Botany for September, 1891.

2. RETICULARIA UMBRINA. Fr. Æthalium pulvinate, roundish, more or less irregular, the surface covered by a thin, silvery, shining, common cortex, which at the base is confluent with the hypothallus. Walls of the sporangia umber or rusty-brown next the base, with broad expansions in places thickly grown together, toward the surface passing into narrow bands and abundant fibrous threads, which rapidly disintegrate. Spores in the mass umber or rusty brown, globose, most of the surface reticulate, 7–9 mic. in diameter.

Growing on old trunks. Æthalium one to several centimeters in extent, and 5–15 mm. in thickness. The walls of the sporangia are much more reduced to the shreddy fibrous condition than in the preceding species, and on this account they much more rapidly disintegrate, causing the æthalium soon to collapse. It is *Reticularia Lycoperdon*, Bull.

3. RETICULARIA ATRA, A. & S. Æthalium pulvinate, variable in form and size, covered with a thin, fragile, blackish, cortical layer. Walls of the sporangia violaceous, next the base with broad expansions, in places more thickly grown together, toward the surface becoming narrow with more abundant fibrous threads, sometimes presenting a loose irregular network, the whole structure, however, quite variable, according to the stage of the disintegration. Spores globose, violet, minutely warted, 14–16 mic. in diameter.

Growing on wood and bark, especially of pine. Æthalium 2 or 3 to several centimeters in extent. This is *Amaurochæte atra* of Rostafinski's monograph, but the structure appears to be altogether similar to that of *Reticularia umbrina.*

II. CLATHROPTYCHIUM, Rost. Æthalium composed of numerous regular erect sporangia, seated in a single compact stratum, on a well-developed hypothallus, the surface formed by the coherent apices. Sporangia at first cylindric, with the apex convex and the wall entire; soon, by mutual pressure, they become prismatic and the lateral faces disappear, leaving the edges and the apex permanent. Spores globose, ochraceous.

1. CLATHROPTYCHIUM RUGULOSUM, Wallr. Æthalium composed of numerous very slender sporangia, closely compacted into a single stratum, and seated on a conspicuous silvery hypothallus; the surface ochroleucous, honey color or olivaceous. The sporangia are typically hexangular when the lateral faces disappear, leaving at the edges six simple triangular threads, extending from the angles of the hexagonal apex downward to the base. Spores in the mass ochraceous, yellowish or brownish, globose, minutely warted, 8–10 mic. in diameter.

Growing on old wood. Æthalium somewhat circular, or often quite irregular in shape, 1 to several centimeters in extent, the individual sporangia nearly 1 mm. in height, but scarcely .1 mm. in thickness. Deviations from the typical form of the sporangia sometimes occur, they are not seldom pentangular, and I have seen the apices quadrangular, with only four threads, or even triangular, and with but three; the threads, too, are said occasionally to branch and anastomose. *Reticularia plumbea*, Fries, S. M. III, 88; and *Ostracoderma spadiceum*, Schw., N. A. Fungi No. 2,381.

III. CRIBRARIA, Pers. Sporangia simple, globose or obovoid, stipitate, often cernuous; the wall regularly thickened on the inner surface in two ways, the lower basal portion by radiating ribs consisting of minute brown granules, the upper part by slender threads combined into a network of polygonal meshes; the basal portion of the membrane is commonly persistent with its thickening and is called the *calyculus*, the upper part nearly always disappears from the network at maturity; there are usually nodules of the brown granules at the angles of the network. Spores globose, purple, brown, ochraceous.

a. Sporangium, large.

1. CRIBRARIA ARGILLACEA, Pers. Sporangia globose or obovoid, stipitate or nearly sessile, standing close together on a thin and evanescent hypothallus; the wall quite firm, silvery-shining, the greater portion persistent, breaking away about the apex; calyculus small, the brown radiating ribs soon passing into a network of polygonal meshes, the threads with irregular granulose-thickened portions at intervals throughout their whole extent. Stipe very short, erect, brown. Spores in the mass argillaceous, globose, 5–7 mic. in diameter.

Growing in large irregular patches on rotten trunks. Sporangia .6–.8 mm. in diameter, the stipe always much shorter than the sporangium, sometimes nearly obsolete. The resemblance of this species to some forms of *Tubulina cæspitosa* is very great.

2. CRIBRARIA VULGARIS, Schrad. Sporangium large, globose, stipitate, somewhat cernuous; the calyculus brown, finely ribbed and granulose within, occupying but a small part of the sporangium; the network of slender threads, with very small nodules at the angles, each with several (3–7) radiating threads, sometimes with one or two free extremities, the meshes triangular or rhombic. Stipe rather short, stout, tapering upward, usually a little bent or curved at the apex, dark purplish brown in color. Spores in the mass pale ochraceous, globose, even, 5–7 mic. in diameter.

Growing on old wood. Sporangium .5–.7 mm. in diameter, the stipe two or three times the diameter of the sporangium in length. Recognized by the large sporangium and the very small nodules with their few radiating threads.

3. CRIBRARIA DICTYDIOIDES, C. & B. Sporangium large, globose, stipitate, cernuous; the calyculus small, with thickish brown ribs, from which the outer thin membrane often disappears soon after maturity; the network of slender threads, with large brown nodules at the angles, more or less elongated and irregular in shape, each with numerous (5–15) radiating threads, usually some with free extremities, the meshes largely triangular. Stipe long, tapering upward, flexuous, curved at the apex, dark purplish-brown in color. Spores in mass pale ochraceous, globose, even, 5–7 mic. in diameter.

Growing on rotten wood, especially of oak. Sporangium .5–.6 mm. in diameter, the stipe from three to five times as long. This species appears to be intermediate between *Cribraria vulgaris* and *Cribraria intricata*; the nodules are usually large and irregular, but the characteristic parallel threads of *C. intricata* do not often occur. The outer membrane of the calyculus is by no means always absent.

4. CRIBRARIA ELEGANS, B. & C. Sporangium rather large, globose, stipitate, somewhat cernuous; the calyculus thickly covered inside with dark purple granules, faintly ribbed, occupying about a third part of the sporangium; the network of slender threads, with large irregular dark purple nodules, quite variable in shape and size, angular and lobed, below sometimes elongated, the meshes very irregular. Stipe rather

short, tapering upward, bent at the apex, dark purple in color. Spores in the mass bright purple, globose, even, 5–7 mic. in diameter.

Growing on old wood. Sporangium .4–.5 mm. in diameter, the stipe two or three times as long. It does not appear to be greatly different from *Cribraria purpurea*, Schrad.

b. Sporangium, small.

5. CRIBRARIA TENELLA. Schrad. Sporangium small, globose, stipitate, cernuous; the calyculus brown, shining, granulose within and faintly ribbed, occupying from one-fourth to one-half the sporangium, sometimes the outer thin membrane early disappearing; the network of slender threads with small roundish or irregular nodules at the angles, each with several (4–8) radiating threads, sometimes two or three with free extremities, the meshes triangular or rhombic. Stipe long, tapering upward, flexuous, curved at the apex, purplish-brown in color. Spores pale ochraceous in mass, globose, even, 5–7 mic. in diameter.

Growing on old wood. The sporangium .3–.4 mm. in diameter, the stipe three to five times as long. This is a much more delicate species than *Cribraria dictydioides*. The calyculus is variable in size; in some examples the thin connecting membrane between the ribs has disappeared.

6. CRIBRARIA MICROCARPA, Schrad. Sporangium very small, globose, stipitate, somewhat cernuous; the calyculus represented by a few short brown ribs, the outer membrane soon disappearing; the network of slender threads, with small roundish nodules at the angles, each with several (4–6) radiating threads, with an occasional free extremity, the meshes largely rhombic. Stipe very long, slender, somewhat flexuous, bent at the apex, purplish-brown in color. Spores in mass pale ochraceous, globose, even, 6–7 mic. in diameter.

Growing on old wood. Sporangium .22–.27 mm. in diameter, the stipes 1–2 mm. in length. Readily distinguished by its very small sporangium and the comparatively very long stem. I am indebted to Dr. George A. Rex for specimens of this species.

7. CRIBRARIA CUPREA, Morg. n. sp. Sporangium very small, oval or somewhat obovoid, stipitate, cernuous; the calyculus copper-colored, finely ribbed and granulose within, occupying from one-third to one-half the sporangium; the network of slender threads, with rather large triangular or quadrilateral meshes, and with large irregular dark copper-colored nodules, each having several (4–7) radiating threads, with an occasional free extremity. Stipe not very long, tapering upward, curved at the apex, of the same color as the sporangium or darker below. Spores pale coppery in mass, globose, even, 6–7 mic. in diameter. See Plate III, Fig. 11.

Growing on old wood. Sporangium .30–.35 × .25–.30 mm., the stipe two to four times as long as the sporangium. A minute species, easily recognized by its almost uniform color of bright new copper.

IV. DICTYDIUM, Schrad. Sporangium simple, depressed-globose, stipitate, cernuous; the wall regularly thickened on the inner surface by numerous convergent ribs, which extend from base to apex and are united by fine transverse fibers, thus forming a network of rectangular meshes; the basal portion of the membrane sometimes persists as a calyculus, the upper part disappears at maturity. Spores globose, purplish.

The ribs run from base to apex like the meridians on a globe; they are simple, or here and there they separate into two divergent branches, which sometimes again converge into one; at the apex of the sporangium there is usually a small irregular net in which all the ribs terminate.

1. DICTYDIUM CERNUUM, Pers. Sporangium depressed-globose, umbilicate at the apex, stipitate, cernuous, purplish-brown in color; the calyculus granulose within, occupying from one-fourth to one-third of the sporangium, the ribs united by firm, persistent fibers. Stipe not very long, erect, tapering upward, bent at the apex, purplish-brown, the apex pale and pellucid, standing on a small hypothallus. Spores purplish-brown in mass, globose, even, 5–7 mic. in diameter.

Growing on old wood. Sporangium .4–.5 mm. in diameter, the stipe two or three times longer than the diameter of the

sporangium. This appears to be the species figured and described by Rostafinski and by Massee.

2. DICTYDIUM LONGIPES, Morg. n. sp. Sporangium large, depressed-globose, the apex umbilicate, stipitate, cernuous, dark purple in color; calyculus usually wholly wanting, the ribs united by weak fibers, which are easily torn asunder, allowing the ribs to curl up inwards. Stipe very long, flexuous, tapering upward, curved and twisted at the apex, dark purple in color, standing on a thin hypothallus. Spores in the mass dark purple, globose, even, 5–7 mic. in diameter. See Plate III, Fig. 12.

Growing on rotten wood, mosses, etc. Sporangium .5–.7 mm. in diameter, the stipe three to five times as long. This is a much larger species than the preceding; it has a uniform dark purple hue, the stipe is very long and much bent and twisted, the ribs of the sporangium are soon torn apart and rolled inward.

MANUAL OF THE PALEONTOLOGY OF THE CINCINNATI GROUP.

BY JOSEPH F. JAMES, M. SC., F. G. S. A., ETC.

PART IV.

(Continued from Vol. xv, p. 100.)

(Read by Title, January 3, 1893.)

Section 2.—*Madreporaria rugosa.*

This section includes such well-known forms as *Zaphrentis*, *Cyathophyllum* and *Streptelasma*. Its general characters are given by Nicholson as follows:* Corallum simple or composite, composed of compact, solid sclerenchyma, the theca complete and imperforate; septa usually well developed and lamellar, with smooth or dentated edges; sometimes rudimentary, generally alternately long and short; mode of increase in the composite corolla mostly by lateral or calicular budding. Three of the genera of our corals are referred here, viz., *Zaphrentis*, *Streptelasma* and *Palæophyllum*.

Genus 1.—ZAPHRENTIS, Rafinesque and Clifford, 1820.

"Corallum simple and trochoid; calice deep, septal fossula strongly developed and occupying the place of one of the septa; no columella; tabulæ moderately developed and bearing on their upper surface a series of septa, which extend from the wall to the center of the visceral chamber, and are denticulate all along their calicular edge." (Ann. Sci. Phys. de Bruxelles, tome v, 1820, p. 234; Ed. and Haime, Brit. Foss. Cor. (Palæont. Soc. Pub., (London, 1850, p. lxv.)

Remarks.—The above description is not the original one of Rafinesque and Clifford, this not being accessible, but the

*Manual of Palæontol., 1889. vol. 1. p. 276.

later one of Edwards and Haime. Only one species has been recorded from the Cincinnati group.

1.—Z. (?) OHIOENSIS, James, 1879.

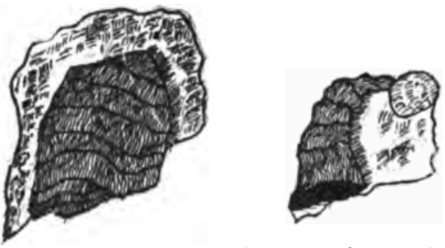

FIG. 8.—*Zaphrentis* (?) *ohioensis*, James. Two examples nat. size. (Original.)

Corallum small, simple, sub-cylindrical, expanding quite rapidly from the base upward; sharply curved about the middle; epitheca thin; slight undulations, and numerous fine encircling lines crossing the small, closely set, longitudinal, sinuous costæ; margin of calice thin; interior and septa not known, being covered in all the examples by rock or other corals; three-fourths of an inch in diameter across the cup and one inch in length. (The Palæontologist, No. 4, July 10, 1879, p. 26.)

Locality.—Mt. Auburn, Cincinnati, O.

Remarks.—Subsequent to the published description, the author of this species was inclined to question its validity. It is inserted here in order that it may receive study from others. The figures are from type specimens in Mr. James's collection.

Genus 2.—STREPTELASMA, Hall, 1847.

Corallum simple, turbinate, free; epitheca well developed; septa well developed, more or less twisted and united with one another toward the center of the visceral chamber, where they sometimes form a species of vesicular tissue; no columella and no dissepiments; tabulæ remote, irregular, and poorly developed; a single septal fosette. (Pal. of N. Y., vol. 1, 1847, p. 69; Nicholson, Pal. of Ohio, vol. 2, 1875, p. 217.)

Remarks.—The above is the description given by Nicholson, as it is fuller than that of Hall. Numerous species have been

referred to the genus, some of them from our own section, but there does not seem good reason for making more than one from the Cincinnati group. It has also been questioned whether it is not the same as *Petraia* described by Munster in 1837. Billings and others have so considered it, but we shall here regard it as distinct.

1.—S. CORNICULUM, Hall, 1847.

Corallum conical, slightly curved or nearly straight, averaging from one to four inches long, and from ten lines to 1½ inches in diameter; septa from 90 to 160, alternately large and small; smaller ones rarely extending much beyond the margin, but the larger ones reaching to the center, where they become more or less twisted and united with one another, forming a mass of vesicular tissue: calice moderately deep; septa very thick, often appearing as if double; tabulæ remote and irregular, sometimes elevated toward the center of the visceral chamber; no dissepiments; epitheca with longitudinal ridges corresponding to the septa within; otherwise smooth, or, rarely, with a few encircling folds. (Pal. of N. Y., vol. 1, 1847, p. 69; Nicholson, Pal. of Ohio, vol. 2, 1875, p. 218.

Locality.—Oxford, Waynesville, Lebanon, Loveland, Cincinnati and other places in Ohio and Indiana.

Remarks.—One of the most common of the fossils of the Cincinnati group, and generally known as the "bull's horn coral." It varies greatly in size—from ½ inch to 4 inches in length. It may be nearly straight or considerably curved, and with a sharp, or a rounded, blunt point. The description above is from the Palæontology of Ohio. It is possible that *Zaphrentis* (?) *ohioensis* may be only a small variety of this species.

Genus 3.—PALÆOPHYLLUM, Billings, 1857.

Corallum fasciculate or aggregate; corallites surrounded by a thick wall; radiating septa extending the whole length; transverse diaphragms either rudimentary or none; increasing by lateral budding. (Geol. Sur. of Canada, Rept. Prog. for 1853, '54, '55, '56, 1857, p. 168; Nicholson, Pal. of Ohio, vol. 2, 1875, p. 219.)

Remarks.—This genus is closely allied to *Streptelasma*, differing from it only in forming masses instead of being single and simple.

1.—P. DIVARICANS, Nicholson, 1875.

Corallum usually free, sometimes apparently attached, compound, formed of from 2 to 6, conical, turbinate corallites, produced by lateral gemmation, or by fission, directed outward from the parent at a more or less open angle and not again in contact; septa from 58 to 62, alternately large and small, large ones twisted toward center of visceral chamber; no dissepiments or columella; tabulæ unknown; epitheca well developed, with ridges corresponding to the septa within, with faint encircling striæ and a few shallow annulations of growth; calice deep, with a flattened space at bottom; free edges of septa without spines or denticulations. (Pal. of Ohio, vol. 2, 1875, p. 220.)

Locality.—Oxford, etc., O.

Section 3.—*Madreporaria perforata.*

Simple or composite, with the corallum more or less porous or reticulate; septa solid or porous, represented by irregular trabeculæ [plates or bars] or calcareous spines; dissepiments usually present, and tabulæ commonly developed. (Nicholson, Man. of Pal., 1889, vol. 1, p. 306.)

This section includes many of the large, widely distributed and best known genera of Paleozoic corals, among them being *Favosites*. Only three genera are represented in our section, and these with only a few species. They are *Alveolites*, *Protaræa*, and *Calapœcia* (*Columnopora*).

Genus 1.—ALVEOLITES, Lamarck, 1801.

Corallum massive, incrusting or ramose, composed of contiguous, compressed corallites, which possess thin walls and open obliquely upon the surface by sub-triangular or semilunar calices; septa sometimes obsolete, but often present in the form of longitudinal rows of spinules, which may be equally developed or reduced to a single, double or treble row by the suppression of the others; tabulæ well developed, com-

plete; mural pores generally few in number, of large size and irregular in their distribution. (Systemé des Animaux sans Vertèbres, 1801, p. 375; Nicholson, Palæozoic Tab. Corals, 1879, p. 117.)

Remarks.—The description given above is that of Nicholson, and it is much more complete than the original of Lamarck. The generic characters are very fully discussed by the former writer, (Ibid., pp. 118–125), and those seeking more detailed information are referred to the above-cited volume.

1.—A. (?) GRANULOSUS, James, 1872.

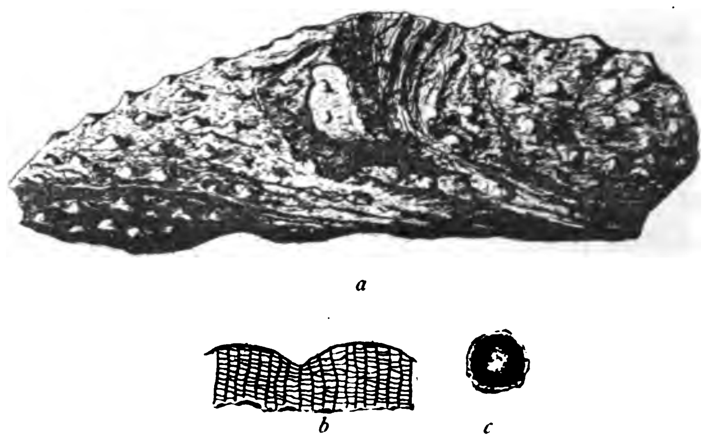

FIG. 9.—*Alveolites* [?] *granulosus*, James—*a*, type specimen reduced one-half; T. Holm, del.; *b*, corallites enlarged; *c*, monticule (original).

Corallum massive, irregular in form, apparently built up of successive layers, variable in thickness, 1 line to ½ inch thick, or more, with apparently solid interlaminar spaces; corallites very thin walled, 3 or 4 in one line; groups of corallites sometimes radiating from different points, growing irregularly, at various angles, short or long, and curving in different directions; surface covered with granules, often with monticules from ¼ to ½ an inch apart, and elevated 1 or 2 lines; calices apparently irregular, crescentric, oval or triangular; tabulæ present. (Cat. Foss. Cin. Group, 1872, p. 2.)

Locality.—Warren and Clinton Counties, Ohio.

Remarks.—This is a peculiar form, and while the type specimen seems to be massive, it has some appearance of being made up of a number of masses which may have a central nucleus. The weathered edges show the corallites to be complete and with rather numerous tabulæ. The surface shows only granules between quite large monticules, and no clearly defined openings.

Genus 2.—PROTARÆA, Ed. and Haime, 1851.

"Corallum incrusting; walls simple, polygonal, bearing at the angles of a majority of the calices small projections; calices shallow, septa less trabeculate than in a majority of the *Poritides;* margin dentate, the innermost teeth looking like a small columella, no pales." (Mon. des Polyp. Foss. des Terr. Palæoz., Archives du Mus. d' Hist. Nat., Paris, 1851, p. 208.)

Remarks.—The above is the description given by Edwards and Haime for a coral described by Hall as *Porites* (?) *vetusta.* (Pal. of N. Y., vol. 1, 1847, p. 71.) I have been unable to find any additions to it by later writers. Only one species, with a possible variety, is known.

1.—P. VETUSTA, Hall, 1847.

"Corallum expanding so as to form a very thin crust, fixed, ordinarily, upon shells of brachiopods, and from which its shape is derived; calices polygonal, somewhat unequal, shallow; walls simple, moderately thick, and often showing at their angles small, column-like prolongations, such as are seen in *Stylocœnia*; 12 septa, alternating, somewhat unequal, rather thick outside, slightly prominent, and forming crenulations upon the wall, free at the margin, dentate, thinner within, where the teeth are much finer, and simulate in the center a columella; papillæ somewhat irregular; calices 1½ mm. to 2 mm. in size." (Ed. and Haime, Ibid., pp. 208–209.) (*Porites* (?) *vetusta*, Hall, 1847.)

Locality.—Oxford, Cincinnati, etc., Ohio.

Remarks.—The above is a free translation of Edwards and Haime's description. The species is also described in the Ohio Palæontology, vol. 2, p. 221. The original description of Hall, which is meager, is as follows: "A sub-hemispheric

coral, composed of irregular concentric laminæ; cells vertical to the laminæ; openings upon the surface nearly circular, with internal vertical lamellæ, which reach one-half way to the center." (Pal. of N. Y., 1847, vol. 1, p. 71.) The form described by Edwards and Haime as *Protaræa verneuili* (l. c. p. 209) does not show any characters sufficient to separate it, even as a variety. The description is as follows: "Corallum forming a convex, elevated mass; calices polygonal, somewhat unequal, separated by walls that are rather thin, and show at their angles small, slender columns; a score of the septa somewhat unequal, rather fine; size of the calices three mm. in diameter.—Alexanderville, Ohio."

Genus 3.—CALAPŒCIA, Billings, 1865.

"Corallum composite, forming hemispherical or sub-spherical colonies; corallites slender, tubular, perforated as in *Favosites*, and with their outside striated by imperfectly developed costæ; radiating septa (in the species at present known), about twenty-four; tabulæ thin, and apparently, in some instances, not complete. When the corallites are not in contact, the space between them is filled with a variously formed vesicular tissue. This genus resembles *Heliolites*, but differs therefrom in having double the number of septa and the walls perforated." (Canad. Naturalist, 2d ser., vol. 2, 1865, p. 425). (*Columnopora* Nicholson, Geol. Mag. new ser., vol. 1, 1874, p. 253; *Houghtonia* Rominger, Foss. Cor. Michigan, 1876, p. 17.)

Remarks.—For a discussion of the affinities of this genus see Nicholson's "Palæozoic Tabulate Corals," 1879, pp. 159–164. Since that volume was written Dr. Nicholson has abandoned his genus in favor of that given above. (See Manual of Palæontology, vol. 1, 1889, p. 317.)

1.—C. CRIBRIFORMIS, Nicholson, 1874.

Corallum massive, hemispheric or pyriform, varying from ten lines to six inches in diameter, and from eight lines to three inches or more in height; corallites spreading from base of attachment, polygonal, generally in close contact and the walls thick and fused together; occasionally sub-circular,

partially separated by interspaces toward their mouths; calices rounded or polygonal, about 1½ lines in diameter, often with smaller ones intercalated, the margins thick and crenulated by the septa; septa about twenty, more or less, forming strong longitudinal ridges passing only a short distance inward; mural pores large, oval, arranged in rows between the septa, separated generally by a space less than their own diameter; tabulæ numerous, complete, flexuous, often uniting with one another, about eight in the space of one line. (Geol. Mag., new ser., vol. 1, 1874, p. 253.) (*Columnopora cribriformis*, Nicholson.)

Locality.—Cincinnati, O.

Remarks.—As above noted, this species was originally described as a *Columnopora*, and it has been generally placed in this genus. Dr. Nicholson has discarded his name in favor of the older one, *Calapœcia*.

Sub-class.—ALCYONARIA.

This sub-class is characterized by the possession of "polypes with eight pinnately fringed tentacles, the mesenteries and intermesenteric chambers being also eight in number. The corallum is usually sclerobasic or spicular, or formed of both an axial sclerobasis and detached spicules. In other types, the polypes composing the colony may be provided with separate thecæ." * The eight tentacles and eight mesenteries chiefly distinguish the sub-class from the *Zoantharia*. The corallum is compound and variable in form, being branching, linear, discoid, frondescent, etc., either fixed by a root-like process or floating free. The corallites are tubular and the tabulæ well developed.

There are numerous living and comparatively few fossil genera, at least in our section. Indeed, there are but two occurring, so far as known, in the Cincinnati Group in Ohio. These have been referred to separate families, and constitute the typical genera. They are *Heliolites* placed in the *Heliolitidæ* and *Tetradium* in the *Tetradiidæ*. We give here the generic and not the family characters. *Heliolites* has one species, and *Tetradium* two or three in our section.

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* Nicholson, Manual of Palæon., vol. 1, 1889, p. 321.

Genus 1.—HELIOLITES (Guettard) Dana, 1846.

Corallum spheroidal, pyriform, hemispherical, or rarely ramose, composed of numerous closely contiguous corallites, divisible into two series; larger corallites cylindrical, comparatively few, with twelve lamellar infoldings of the wall, of the nature of pseudo-septa, which fall short of the axis of the visceral chamber; small corallites completely investing the larger ones, more or less polygonal, with distinct walls, completely amalgamated with one another and with the walls of the larger tubes, but not known to be provided with apertures allowing lateral communication; small tubes without septa, but with numerous straight and complete tabulæ, similar but less numerous ones being found in the larger tubes; no columella. (Mém., vol. 3, p. 454, pl. 22, Figs. 13, 14; Dana, U. S. Exploring Exped., vol. 8, *Zoophytes*, 1846, p. 541; Nicholson, Pal. Tab. Cor., 1879, p. 243.)

Remarks.—As noted above, the generic name appears to have been first used by Guettard, and was adopted by Dana in 1846. His description is quite meager, and therefore the more complete one given above has been taken from Nicholson.

1.—H. SHEPARDI, James, 1878.

Corallum hemispheric or discoid, from one-half an inch to an inch in diameter; cell apertures one-half a line to a line in diameter, generally two or more lines apart, sometimes only one line; margins thin, little, or not at all elevated above the surface; septa twelve, well developed; spaces between the corallites thickly set with pit-like markings (cells); base of corallum flat, convex, or with a groove between the outer edge and a saucer-like depression in the center; internal structure unknown. (The Palæontologist, No. 1, July 2, 1878, p. 2.)

Locality.—Brush Creek, Adams Co , O.

Remarks.—It is to be regretted that it is impossible to figure this species. Only four specimens were known to Mr. James, and these, together with a description, were deposited with the publication committee of a scientific society, and have never been seen since. The publication of the description in

this place may lead to the discovery or identification of other specimens.

Genus 2.—TETRADIUM, Dana, 1846.

Corallum massive, composed of long, prismatic and closely contiguous corallites, without mural pores; septa distinct, few, generally four, short, not reaching to the center of the visceral chamber, appearing like inflections of the wall; calices generally petaloid; tabulæ numerous, complete; increase apparently by fission of old tubes. (U. S. Explor. Exped., vol. 8, *Zoophytes*, 1846, p. 701; Nicholson, Pal. Tab. Cor., 1879, p. 231.)

Remarks.—The above is Nicholson's description of the genus. That given by Dana, although short, covers the main points. It is as follows: "Corallum massive, consisting of four-sided tubes, and cells with very thin septa or parietes; cells stellate, with four narrow lamellæ." Safford made the following remarks later on: (Am. Jour. Science, 2d ser., vol. 22, 1856, p. 236.) "The tubes in the different species vary from ¼ of a line to nearly 1 line in breadth; they are very long, and are most frequently united throughout laterally, forming massive coralla, resembling, more or less, those of *Favosites* and *Chætetes;* sometimes, however, they are united in a single intersecting series, as in *Halysites catenulata*, Linn.; not unfrequently, too, the tubes are isolated, or only united at irregular intervals, thus forming loose fasciculated coralla, resembling certain forms of *Syringopora*."

1.—T. FIBRATUM, Safford, 1856.

"Coralla massive, hemispherical or flattened hemispherical, composed of diverging tubes; cell tubes four-sided, with thin and slightly rugose walls; the four lamellæ distinct, nearly reaching the center of the tubes; breadth of full-grown tubes usually about, or but little more than ½ a line, varying occasionally from ⅓ to ¾ of a line; transverse septa usually absent; a few have been seen in one specimen, which were about twice the breadth of a tube apart." (Am. Jour. Sci., 2d ser., vol. 22, 1856, p. 237.)

Locality.—Oxford, Ohio, and other places in the upper beds of the group.

Remarks.—This species frequently forms masses of considerable size, and when weathered shows long parallel tubes, like organ pipes on a small scale.

2.—T. MINUS, Safford, 1856.

Corallum massive, hemispherical or amorphous, composed of slender, closely approximated corallites diverging from an imaginary axis; corallites sometimes 3 inches long, about 1/3 to 1/4 of a line wide, the walls tolerably thick and four or five-sided; septa 4, imperfectly preserved and often detected with difficulty; tabulæ well developed, complete and remote, 5 or 6 to a line. (Ibid., p. 238; Nicholson, Pal. of Ohio, vol. 2, 1875, p. 222.)

Locality.—Cincinnati, Lebanon, Waynesville, etc, Ohio.

Remarks.—The description given of this species by Safford is very meager, consisting of the statement that the specimens are generally small, the tubes 1/4 to 1/3 of a line broad, regular or irregular, generally four-sided, and with the lamellæ as in *T. fibratum.* We have, therefore, given the above description as printed in the Palæontology of Ohio.

3.—T. COLUMNARE, Hall, 1847.

Corallum massive, a foot or more in diameter, hemispherical or sub-globose, consisting of a series of parallel or diverging polygonal tubes; tubes four or five-sided, simple, without visible transverse dissepiments or connecting pores; interior of cells apparently rugose or denticulate. (*Chætetes columnaris*, Hall, Pal. of N. Y., 1847, vol. 1, p. 68.)

Locality.—Upper part of Cincinnati Group.

Remarks.—This species, originally described as a species of *Chætetes*, is recorded by Ulrich (Cat. Foss. Cin. Gr., 1880,) as occurring in the upper part of the Group. While it differs from the two other species in its general appearance and mode of growth, it seems to belong to the present genus, where it was, in fact, placed by Safford as long ago as 1856. (l. c., p. 237.) It has the characteristic square tubes, and, while the cruciform character is not well marked, there are indications of indentations of the walls in well-preserved specimens.

A fourth species is given by Ulrich, *T. (Phytopsis) cellulosum*, Hall, but this is evidently a form belonging to a lower horizon than the Cincinnati Group.

Sub-class.—MONTICULIPOROIDEA.

A group of fossils presenting a great diversity of forms, known only from Paleozoic formations and occurring mainly in the Lower Silurian; corallum varying from massive to discoid, laminar, ramose or parasitic, and made up of corallites contiguous throughout their entire length, but each possessing a distinct wall; mural pores absent; spiniform corallites frequently present about the calices and usually at the angles of junction of the corallites; cells all of the same size or in two sets, one large and one small; tabulæ generally present, complete and straight, or incomplete and curved; an epithecal membrane sometimes present and the cell openings frequently closed by opercula.

As the soft parts of the animals are entirely unknown, nothing can be said about their structure. As here considered there is but one genus, with three sub-genera. Some authors have divided the genus *Monticulipora* into five sub-genera, and consider the three here placed as sub-genera, viz., *Dekayia*, *Fistulipora* and *Constellaria*, as distinct. The five sub-genera given by Nicholson and other conservative authors are *Heterotrypa*, *Diplotrypa*, *Monotrypa*, *Prasopora* and *Peronopora*. Others have coined a large number of names that may and may not be considered valid in the future. With that we are not here concerned.

Genus I.—MONTICULIPORA, D'Orbigny, 1850.

Corallum variable in shape, massive, ramose, laminar, frondescent, incrusting, or assuming a certain peculiar form; attached or floating free; composed of numerous tubular corallites, the walls not amalgamated with each other, and without pores, tubes mostly of two kinds, one, (interstitial) smaller than the other, and differing in internal features; interior of the tubes with few or many complete tabulæ, or diaphragms, or more or less vesicular (in sub-genus FISTULIPORA); the interstitial cells more closely tabulate than the

larger ones, and sometimes so numerous as to completely isolate the large tubes from one another (in sub-genus FISTULIPORA); the apertures of the cells generally straight, sometimes more or less oblique, varying in shape from circular, oval, hexagonal or polygonal, to square or rhombic; surface often showing at intervals areas occupied by corallites larger or smaller than the average; if elevated above the surface known as "monticules," and if on or below it, as "maculæ;" sometimes forming (in sub-genus CONSTELLARIA), star-shaped elevations, more or less thickly scattered over the surface; spiniform corallites more or less numerous, placed either at the angles, on the edges of the cells, or, at times, projecting into the cell cavity; sometimes (in sub-genus DEKAYIA), projecting above the surface as conspicuous blunt spines. (Prodrome de Paleont, tome I, 1850, p. 25; Nicholson, Pal. Tab. Corals, 1879, p. 269; The Genus Montic., 1881, p. 30 *et seq.*)

Remarks.—The above description has been purposely made broad enough to cover the many genera that have, from time to time, been published. The reasons for this are more fully set forth in another place,* to which the student is referred. Attention is also called to Nicholson's "The Genus Monticulipora" for a very full exposition of the features of the genus and descriptions of many species. In the references to the species given below, generally only the original place of publication will be cited.

The genus is divided into six groups, founded on the external form of the corallum. While this may be considered an artificial arrangement, it is, at the same time, believed to be one more useful to the student than what might be termed a natural arrangement based upon internal structure. The groups are: I. *Massive;* II. *Discoid;* III. *Dendroid* or *Ramose;* IV. *Laminar* or *Frondescent;* V. *Incrusting* or *Parasitic;* VI. Species imitating foreign bodies. Each of these groups will be separately considered.

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*On the Monticuliporoid Corals of the Cincinnati Group, with a critical revision of the species. By U. P. James and Joseph F. James. Jour. Cin. Soc. Nat. Hist., vol. 10, pp. 118–141.

GROUP I.—*Massive;* Free, or attached at one point or by the whole of the base; more or less spheriodal, globose or massive.

a. Surface smooth; corallum massive.................. 1
Corallum free, spheriodal....................... 2
b. Surface not smooth; massive, with monticules...... 3
Spheriodal, nodulated.......................... 4

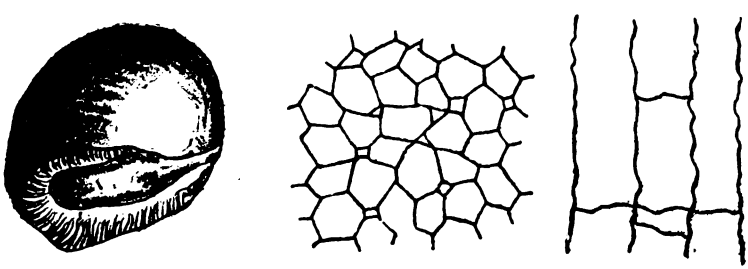
1.—M. UNDULATA, Nicholson, 1875.

Corallum forming large, lobed or laterally indented masses, with a maximum diameter of four inches and a height of about two inches, the upper surface nearly flat; corallites thin walled, angular and prismatic; calices sub-equal, with occasional clusters of six or more, forming small patches, which are faintly or not at all raised above the general surface; small corallites sometimes present at the angles of junction of the larger tubes; tabulæ few, complete, placed at corresponding levels in contiguous tubes. (Geol. Mag., decade 2, vol. 2, 1875, p. 176.)

Locality.—Ontario.

Remarks.—This form, as far as at present known, has only been found in the Trenton of Canada. A small hemispherical or spheroidal form occurring in the Cincinnati Group has been placed here by Dr. Nicholson, without a special name. This is described below under a varietal name. The above description is given so that the species may be recognized in case it be found in our region.

var. HEMISPHERICA, n. var.



a *b* *c*

FIG. 10.—*Monticulipora undulata*, var. *hemispherica*, n. var. *a* corallum, nat. size; *b* tangential section x 18; *c* longitudinal section x 18. (After Nicholson.)

Corallum rounded or irregularly spheroidal, generally 1 to 1½ inches in diameter, and sometimes growing around the stem of a crinoid; calices not observed on the exterior; corallites resembling the type (*undulata*) thin walled, prismatic, with occasional smaller cells placed at the angles; tabulæ few and remote. (See Nicholson, Genus Montic., 1879, p. 173.)

Locality.—Hudson River group of various places in Ontario.

Remarks.—In a previous paper by the author in connection with U. P. James* this variety was considered the same as *M. turbinata*, James. It seems evident now that this disposition is not a tenable one. It differs greatly externally from *M. undulata*, and resembles *M. turbinata.* Internally it resembles the former and differs from the latter. The figure is copied from Dr. Nicholson's monograph.

2.—M. TURBINATA, U. P. James, 1878.

Corallum free, forming globular, pear-shaped or irregularly rounded masses, from one quarter of an inch to an inch or more in diameter; surface smooth; calices polygonal or subcircular, sub-equal, sometimes larger at the base; maculæ consisting of groups of six or more slightly larger calices scattered over, and only a little or not all raised above the surface; a few minute tubes wedged in at the angles of junction of some of the larger tubes; walls shown, in fractured specimens, to be strongly wrinkled; tabulæ few in number. (The Palæontologist, No. 2, Sept. 14, 1878, p. 11.) (*Chætetes subglobosa*, Ulrich, Jour. Cin. Soc. Nat. Hist., (Feb., 1880,) vol. 2, p. 129.)

Locality.—Cincinnati and Batavia, Ohio, and Covington, Kentucky.

Remarks.—As noted in a previous paper† this species was described in 1878 as *Chætetes turbinatum.* Subsequently (February, 1880), Mr. Ulrich's name of *C. subglobosus* was published. It is an obvious synoym of the present species.

3.—M. FILIASA, D'Orbigny, 1850.

" Corallum mainly fixed on shells, the surface very strongly convex, presenting small, round monticules, sub-conical, a few

*Jour. Cin. Soc. Nat. Hist., vol. 10, p. 161.

†Jour. Cin. Soc. Nat. Hist., vol. 10, p. 161.

prominent, scarcely larger than 2 mm., and distant from each other by double their diameter; the largest calices on certain of the monticules are scarcely ¼ or ⅓ mm. broad." (Prod. de Paleont., 1850, vol. 1, p. 25. Edwards and Haime, Poly. Foss. des Ter. Palæoz. Archives du Mus. d' Hist. Nat., 1851, vol. 5, p. 266.)

Locality.—Cincinnati, Oxford, etc., Ohio; Madison, Indiana; Covington, Kentucky, etc.

Remarks.—This is an illy-defined form. It was named and described or characterized in 1850 in a single line by D'Orbigny. In 1851 Edwards and Haime re-described and illustrated it, and this description is quoted above. The corallites are thin-walled and sub-equal, without interstitial cells. Specimens are found from 4 to 5 inches in diameter attached to shells of *Ambonychia.* I have seen one of these in which the corallum extended an inch beyond the shell upon which it grew, and the bases of the corallites were plainly visible. The upper surface showed numerous elevations that seemed almost like the beginnings of branches. The tabulæ of the cells are complete and horizontal, and may be close or remote, according to the point at which the section has been made.

4.—M. IRREGULARIS, Ulrich, 1880.

Corallum small, about ¾ of an inch in diameter, spheroidal, and apparently free; surface nearly smooth or covered with nodules; monticules none; corallites of one kind only, thin-walled, polygonal, radiating outward from one point to all parts of the surface; tabulæ almost obsolete, although complete, transverse partitions are occasionally developed, generally at corresponding levels in contiguous tubes. (Jour. Cin. Soc. Nat. Hist., vol. 2, (Feb., 1880,) p. 129; Nicholson, Genus Montic., 1881, p. 177.)

Locality.—Hamilton, Morrow, etc., Ohio.

Remarks.—This species is similar to *M. turbinata* in shape, but it is easily separated by the nodulated surface and smaller corallites. In the collection of the late Mr. U. P. James is a specimen with a conspicuous pointed base and a puff-ball like form. Another has six conspicuous nodulations, the surface of these being entirely smooth.

[TO BE CONTINUED.]

MICROSCOPICAL STUDY OF OHIO LIMESTONES.

BY G. PERRY GRIMSLEY, M. A., COLUMBUS, OHIO.

Although the general characteristics of the Ohio limestones have been carefully investigated, both from an economical and paleontological point of view, no extended study has as yet been made of their microscopical structure. That we may have a complete knowledge of the history and structure of limestones, this part of the study should by no means be overlooked.

The application of the microscope to the examination of rocks in thin sections is a result of experiments of men now living, and, as a result of their labors, a new branch of science has come into existence known as *Microscopical Petrography*.

For a couple of centuries men had been experimenting along this line, but these were but the glimmering rays in the darkness and perplexity of mineral study, heralding the coming of a brighter light, which would reveal a new and vast field for experiment and thought.

The year 1850 may be said to mark the beginning of *Modern Petrography*, when Mr. H. C. Sorby, of England, applied the microscope to the examination of thin rock sections. But it was in Germany that the greatest progress has been made, and now the leader in the new science is the German investigator, Rosenbusch, whose first great work appeared in 1873. This soon attracted workers from all parts of the world. American students brought the science across the water, and now we have the names of Williams, Iddings, Cross, Wadsworth, Adams and other workers connected with the science. Such is a brief account of the introduction of the microscope into geological work.

The aim of the present paper is to note the structure, as revealed by the microscope, of the great limestones of the Ohio scale in their geological order, devoting especial atten-

tion to the waterlime group, which is regarded by some as fossiliferous, and by others unfossiliferous.

Our Ohio column begins with the

LOWER SILURIAN SERIES.

The remnants of the old Silurian or Ordovician Sea in Ohio occupy about a dozen counties in the southwestern corner of the State. The beds are highly fossiliferous, containing large numbers of brachiopods, lamellibranchs, trilobites and crinoids, so that the region forms the best collecting ground in the State for the paleontologist. This is the oldest formation of the geological scale of the State, and its life and general microscopical character have been studied with greater care and completeness than any other group, but its microscopical characters have never been investigated.

Selecting carefully a dozen slides, and examining them under the microscope, we find revealed to the eye monticuliporoids, with the species *mammulata* and *ramosa* especially abundant; the Trenton tentaculite; the spiny head shield of acidaspis; crinoid joints very numerous; and with these fragments of shells, with their characteristic structure, of these only one was perfect enough for identification—the small *Cyclora minuta*.

Numerous crystals of calcite or dolomite occur, showing the characteristic rhombohedral cleavage. It is impossible to separate these two minerals under the microscope, but, as this is a magnesian limestone, the crystals might be termed dolomite.

A very fine section of *Ptilodictya fenestelliformis* was observed, which did not appear before the grinding, thus showing, in a slight way at least, the utility of microscopic examination of rocks.

The predominant structure consists of shells and coral remains, either entire or broken. These shell fragments, though too small for identification, are yet useful to show the minute shell structure, appearing under a low power as mere dots, but under a high power are resolved into obscure wavy lines and circles. These various structures found show the diversity of life in the old seas, and prove that, while brachiopods and polyzoans form the greater part of the preserved

life, they were not the only denizens of that far-away time. The greater part of the limestone is made from the shells and corals, both in their original form, and secondarily as a result of solution. The matter in solution was partly lost, partly deposited in an amorphous form, making a cement to hold the fragments together, and partly in a crystallized form, as calcite or dolomite, although the latter is probably a result of a replacement of the calcium molecule by the magnesian.

The limestone, then, consists of shell and coral fragments of varying size, associated with other forms of fossil life, imbedded in a semi-crystalline matrix composed of still finer fragments, resulting from solution and pressure, firmly cemented together by carbonate of lime, resulting from the solution of shells and corals.

Looking back into that far-away epoch, one can picture the conditions and changes which aided the formation of these limestones. The molluscan animals and polyzoans inhabited the Ordovician Sea in great numbers, and, dying, sank to the bottom, where they were gradually consolidated under moderate pressure and by the action of the water into masses of soft limestone, growing and undergoing changes until the land was elevated and the sea pushed southward. This change was very gradual, for the rocks show no effects of metamorphism or of great disturbance. Many of these shell masses are yet unconsolidated, and are exact counterparts of the *coquina*, or shell rock, of the Florida coast of to-day. Their existence was a quiet one, much like the condition of the Mexican Gulf of the present time; the changes were few and slow, as if the end had been reached, and henceforth there was to be no change, but underneath flowed the quiet current of progressive evolution, whose work is not visible in a day or year, but ages. And, no doubt, this remnant of the old Silurian Gulf, which we know as the Mexican Gulf, will grow less by new additions much like these old, destined at last to unite completely the two continents, and add a new series to the geological scale of the future. The changes there to-day, slow as they seem to be, are no slower than the changes in the old Silurian Gulf, which geological exploration and study seem to have proven to be nothing more or less than the ancestor of the Southern Gulf.

Ascending the geological column of the State, we next find the

CLINTON GROUP,

A narrow fringe forming the boundary between the lower Silurian and Niagara foundations. The formation is of small extent, and in composition is almost a pure carbonate of lime. The limestone is highly fossiliferous, consisting of brachiopods, corals, and crinoids.

This series in Ohio has been a disputed one, many contending it is only a part of the Niagara, but its invariably lighter color, pure composition, and distinct fossils, many of which are identical with the Clinton of other States, indicate a new and distinct series.

Thin sections show many fragments of *Clathropora*, probably the *clintonensis*, a few fragments of Favosites, with other corals and a few shells. One layer of a light brown color, probably colored by iron, is quite compact, semi-crystalline, and only sparingly fossiliferous. Another form of the rock is of a light color, crystalline, and made up almost entirely of fragments of crinoids, being a typical crinoidal limestone. The crystals making up the remainder of the rock are calcite. Almost all of the sections contain some fragments of crinoids, and this was an age of crinoids, in distinction from the lower group. On account of the beds of iron ore found at this horizon, and the great yield of gas in the newer fields, it would be inferred that vegetable life was abundant at this time, but there are no definite proofs of the fact. The diversity of life continued into this period, but many of the old forms have passed away and new ones have taken their place. The limestone is more compact, harder and more cystalline, almost a marble in texture, and is a very pure carbonate of lime. The Clinton period in Ohio was a brief one, and was followed by the more extensive

NIAGARA SERIES,

Consisting of shales and a magnesian limestone, with considerable fossil life, which is mainly preserved in the form of internal casts. The characteristic forms being *Pentamerus*, *Trimerella*, *Monomerella*, and *Atrypa*.

The area extends over a large portion of Southwestern

Ohio, and a smaller area in the northern part of the State. This marks the second great limestone formation in the scale, and doubtless was deposited in the Niagara Sea as a pure carbonate of lime, but, by a slow dolomitic replacement, was changed into a fairly pure dolomite, and now is used quite extensively as a source of magnesian lime. From these facts it will be seen that a microscopical study will not be as satisfactory as heretofore, for but little original fossil matter is left. The dolomite crystals are very apt to break out in the process of grinding, thus leaving open, irregular spaces through the section. Fossil structure is seen in very small amount, consisting of a few fragments of crinoids, which seem to have withstood the change, and a few small fragments of coral of the form *Clathropora*. The shells are completely obliterated, and a careful observation has failed to reveal the slightest trace of such structure.

The casts indicate an abundance of life, so we would infer that the Ohio deposit has had bad luck, probably shut off from the ocean to form an evaporating basin, which greatly aided the change from a limestone, like those before it, into the compact, almost structureless, rock we now find. Doubtless there was here a great diversity of life, of which even the record has perished.

All the formations studied thus far have proven fossiliferous to a high degree, life seemed to be abundant, but now we come to a break, to a series which seems to be unfossiliferous, the

LOWER HELDERBERG FORMATION,

Or waterlime group of Ohio, which consists of a magnesian limestone, inclosing at a number of points large beds of rock salt and gypsum. This formation covers two dozen counties of the State, and the limestone contains a notable percentage of bituminous matter, appearing in streaks through the rock, which accounts for the odor of petroleum when it is struck with the hammer.

It has long been regarded unfossiliferous, with the exception of a few casts, the most common being the small coffee grain fossil, *Leperditia alta*. The explanation which has been given is based on the existence of the beds of salt and gypsum, many regarding this portion of the geological series as the

remnant of an old isolated sea basin, which slowly evaporated. The water, becoming salty and bitter, would destroy all life which happened to be present, and on the bottom of this inland sea would be deposited a dolomitic limestone, but no true carbonate, so that all traces of life would be destroyed.

In 1880, some blocks of this limestone were polished for the National Museum at Washington, and it was stated that "one polished upon the surface parallel to the plane of stratification showed a fossil bryozoan, and thus proved it was fossiliferous."

This structure does resemble somewhat a fossil, but Mr. C. D. Walcott, paleontologist of the U. S. Survey, could see in it no proof for calling the limestone fossiliferous. In twenty-five sections of this stone, taken from different parts of the series, I could find no distinct fossil structure.

The rock is compact, containing numerous black lines of bituminous matter, which simulate coralline structure, and all very confusing. With a little imagination one can trace out *hydrocorallines* and even tube and radiating structure of *Cænostroma*, but yet there is nothing definite—nothing that can be regarded as fossil structure beyond doubt. The bitumen has a peculiar regular parallel and radial arrangement, and it suggests that perhaps there is a replacement of the old hydrocoralline mass by bitumen, so that we have, as it were, a bituminous cast.

After careful study and thought, it seems to me that this sea must have contained a considerable amount of life, but that this basin was cut off from the main part, then, by its evaporation, destroyed the life; but the limestone was deposited as a carbonate, soon to be replaced by the various magnesian salts, so that the fossil shell and coral were soon replaced, and only casts remained; then, by consolidation through pressure, even these casts were destroyed. This pressure is shown by occurrence of small pressure columns in the limestone. We are forced, then, to say that the *Helderberg limestone of Ohio is very sparingly fossiliferous*, even in microscopic sections, but we can not say *the Helderberg sea in Ohio was without life*.

The last great limestone we find in the Ohio scale is the

DEVONIAN,

or Corniferous, extending, as a narrow strip, 8–20 miles in width, through central portion of the State. The limestone is quite a pure carbonate, abundantly fossiliferous, containing brachiopods and reef building corals in great abundance. It is here that we find the first abundant plant and fish life preserved.

At Columbus, probably, the best development is to be found. The upper portion is shaly, with very few fossils, and these are mainly fish remains; below this stratum comes a brown and white chert, which is not acted upon by acids. The fossils in this chert are very finely preserved, even the delicate markings coming distinctly to view. Below this comes the bone bed, a comparatively thin layer made up of the teeth and remains of fish, while below this lies the great mass of limestone used for lime and building purposes. The microscope reveals many interesting and puzzling fossil forms.

The brown chert is very compact, but contains a few fragments of shells, crinoid joints, and a number of light spaces, highly crystalline, whose origin is to be traced to the replacement of organic life by crystalline matter.

The white chert is more abundantly fossiliferous. even to the naked eye, but under the microscope it is one mass of fossil life, crinoid stems being especially numerous. There are a number of forms belonging to the group *Porifera*, or the order of sponges, sponge spicules being found through the rock. This is the first time they have been reported from the Ohio Devonian. The chert has an organic origin, and we have a good example of a silica replacement of limestone. We can even make a series of gradations to this end; starting with the limestone, then taking the white chert, abundantly fossiliferous in many places, then the brown chert, which is only slightly fossiliferous, and I have found several specimens of a hard brown chert covered by a layer of perfect minute quartz crystals, and this again covered by chert, suggesting a still further change, due to partial solution and deposit. This accords very closely with the observations with regard to the carboniferous flints made by Dr. Hinde, of England, whereby he proves their organic origin.

The limestone proper is mainly compact and semi-crystalline,

consisting of broken shell fragments better preserved than any yet seen. Coralline structure is also shown, the lace corals especially. Crinoid stems occur in various shapes, the five-sided form being most common.

Among all the sections there can be traced a great similarity. The limestone, under the microscope, is seen to be quite uniform, and confirms the observation made in the quarries that the abundant and predominant forms are brachiopod shells. One section showed the fossil *Styliola*, a pteropod shell, which often forms whole masses of Devonian limestone, but is very rare in Ohio Devonian. This completes the second series, which is characterized by an abundance of fossil life.

The Silurian and Devonian periods have preserved to us, under favorable conditions, the great chapters of the life history of the past.

The study of the carboniferous limestones is as yet incomplete, but a number of new facts are coming to light, and certain limestones long regarded as unfossiliferous are found to contain a variety of fossil forms, only revealed by the microscope.

(ABSTRACT.)

NIAGARA'S WATER POWER.

BY B. M. RICKETTS, PH. B., M. D.

Read January 3, 1893.

Niagara is in latitude 43 degrees, 16 seconds North; longitude 2 degrees and 5 seconds West from Washington, or 79 degrees and 5 seconds West from Greenwich.

The word Niagara is of Indian origin, borrowed from the language of the Iroquois, and means the "Thunder of Waters." There are five gorges of about equal depth, width and length within a radius of thirty miles of Niagara River (all to the West) showing that the river's course had as many times been changed. There is a possibility of there having been three separate falls, one above the other, when the falls first began to recede.

Over Niagara pour 58,000 barrels of water per second; 3,480,000 per minute; 208,800,000 per hour. Its sources are Lake Erie, 290 miles long, 65 miles wide, 210 feet deep; Lake Superior, 355 miles long, 160 miles wide, 1,000 feet deep; Lake Huron, 260 miles long, 100 miles wide, 1,000 feet deep; Lake Michigan, 320 miles long, 70 miles wide, 1,000 feet deep; Lake St. Clair, 49 miles long, 15 miles wide, 20 feet deep.

These lakes are the receptacle of all the surface water extending over 150,000 square miles, almost one-half of the continent. With such a supply the waterfall at Niagara is never noticeably diminished; hence the inducements offered to capitalists to utilize this immense waterfall for manufacturing purposes.

The first method of utilizing the water-power at Niagara on a large scale was by the old hydraulic canal, which commenced on the shore of the river above the falls, extending about three-quarters of a mile to its discharge place on the

high bank of the gorge below the falls. Its capacity has been overtaxed. Of the five sources of power, water occupies the second place, steam the first, wind-mills the third, animal power the fourth, the solar engine of Ericsson the fifth. Water wheels have always furnished, and still furnish, the cheapest mode of producing power at points where power is in great demand at places distant from any waterfall (and demanded also in portable form); the engine could in no wise compete with water-power.

By offering a ready and commercially practicable method of transmitting power, the modern methods of electrical, pneumatic, hydraulic and wire-rope transmission of power have enhanced the values of existing water-powers very much. Especially is this true in the case of water-powers hitherto utilized, or which were not hitherto utilized; and it is largely owing to this modern development of methods of power transmission that a beginning has been made in the utilization of some portion of this waterfall.

Now, that electric motors may be run at a distance of 125 miles from the seat of power, it can readily be seen what the result will be. Niagara being in the center of a circle 250 miles in diameter, will surely be looked upon as the greatest water-power the world can produce, and, with transmission of power at Frankfort and elsewhere, gives promise of much more work of this sort in the future.

A tunnel has been constructed, 7,600 feet long, to form the tail race to be jointly used by all the mill sites. Large tracts of land were purchased by the company within the city on the river bank.

The tunnel is for 100,000 horse-power, and is 19 feet wide and 21 feet high inside the brickwork, with which it is lined throughout. The base of the tunnel is 205 feet below the sill of the head-gate at the entrance of the main canal from the river above the falls. This represents the total fall, of which 140 feet will be available, the difference being taken up by the allowance for clearance from the wheel pits, incline of the lateral tunnels leading therefrom to the main discharge tunnel, and the incline of the latter, which is made at a grade of 36 feet to the mile. The tunnel is lined on the invert and sides a distance of 200 feet back from the discharge point

with closely fitted cast-iron plates, there being a heavy cast-iron frame at the mouth, and the tunnel is furthermore lined throughout with four courses (a total of 16 inches) of brick. The excavation was made on three different benches. The top one 9 feet high to the top of the arch, being always extended ahead of the second bench, 8 feet high, the workmen in the latter bench being covered by a flooring, over which the material excavated from the top bench was conveyed backward on the small dump-cars.

The excavation on the bottom bench, which measured 9 feet vertically to the bottom of the invert, was not commenced until the work on the other two benches had been nearly completed. After the work was well under way the rock-cutting was effected at a rapid rate, 338 feet of tunnel, averaging 14 yards to the running foot, having been excavated in 26½ days. Shaft No. 1, 2,650 feet from the portal, was sunk 206 feet, and is 10 by 20 feet in size, while shaft No. 2, of the same size and 196 feet deep, is 5,200 feet from the discharge point. One hundred and forty feet of the shafts were through hard bastard limestone, which overlays the Niagara slate or Utica shale, met with for the remaining distance, and through which the main tunnel itself was mostly made; its base, as it reached away from the river, being in Queenstowne limestone.

The largest turbine wheel now in existence is 500 horse-power. Those to be used by this company are to represent 5,000 horse-power each. The four polar dynamos, with drum armatures, will be directly connected with the shafts of the turbines, which will make 250 revolutions per minute. The cost of water-wheels, exclusive of excavation and erection, and also exclusive of pumps, compressors, and dynamos, is given at $3.90 per horse-power. The wheels are to be guaranteed at 80 per cent. efficiency, although the makers expect 85 per cent.

Contracts will be made to furnish power on the company's grounds at the falls for 24-hour days according to the following approximate scale: For 5,000 horse-power, $10.00 per horse-power; for 4,500, $10.50; for 4,000, $11.00; and $20,00 for 300 horse-power; all under this being supplied by electro-motors.

DESCRIPTION OF A NEW PHALLOID.

BY A. P. MORGAN.

The following new and very singular member of the Phalloideæ was first found by me nearly ten years ago.

The plate which illustrates it is a copy of one made in oil-colors, and dated June 30, 1883. On account of my scanty material and the abnormal structure of the plant, I did not venture to publish it among my North American Phalloideæ. Since that time, however, I have received specimens from Granville, Ohio, sent by Prof. C. J. Herrick, and from Syracuse, New York, and from West Goshen, Connecticut, sent by Prof. L. M. Underwood.

Being well satisfied that the plant has never before been described, and having good and sufficient evidence of its growth and very peculiar and abnormal structure, I, therefore, now proceed to describe and figure it as I understand it.

PHALLOGASTER, Morgan, Gen., nov.

Mycelium fibrous, much branched. Peridium obovoid, consisting of two concrete layers, an inner and an outer one, rupturing irregularly. Gleba composed of numerous roundish irregular masses, or lobes of a green color, attached to the inner surface of the upper part of the peridium; spores minute, oblong, hyaline.

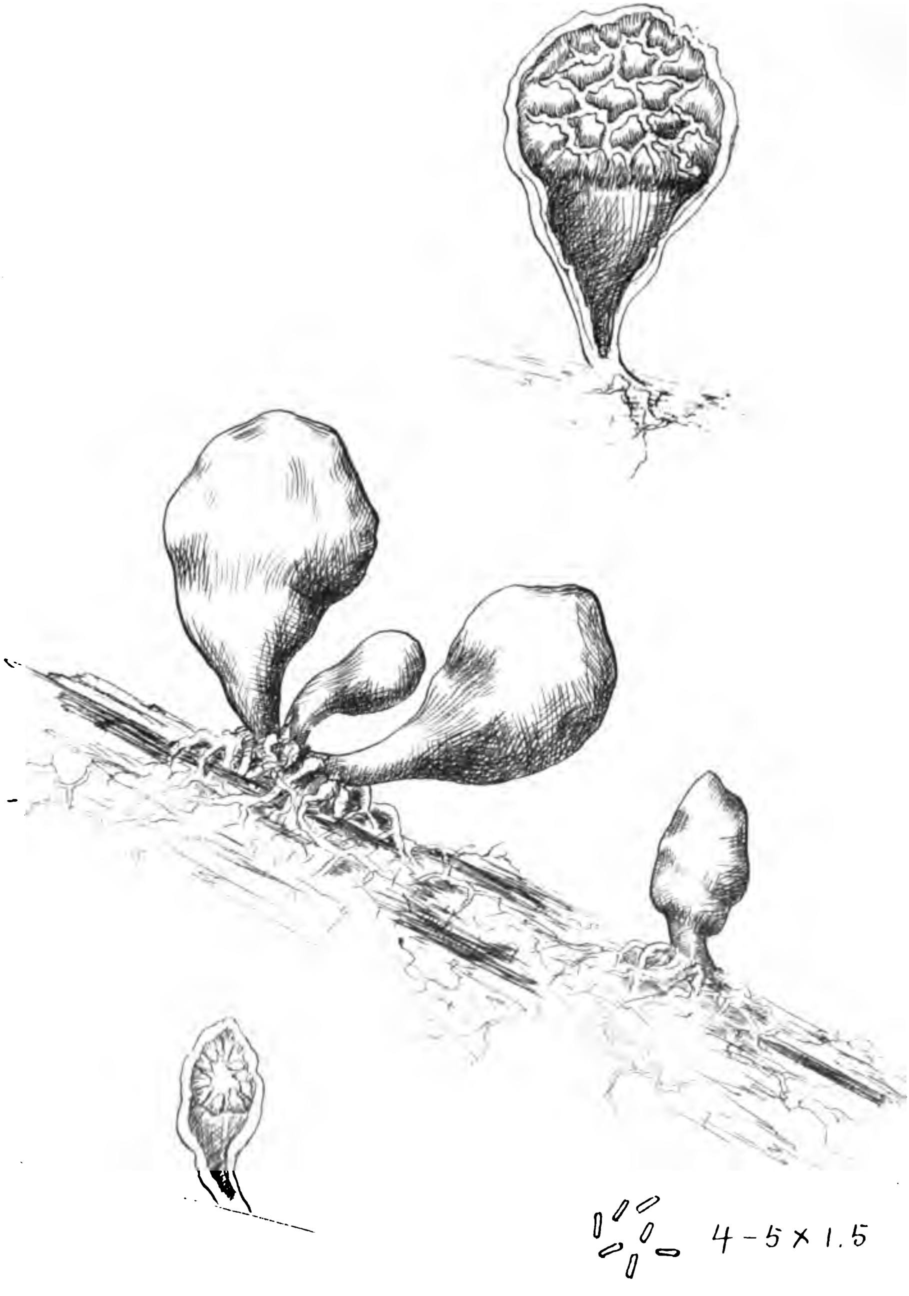
This is a remarkably abnormal member of the Phalloideæ. It does not develop an enlarged receptacle with a volva at the base, and there is no gelatinous layer between the inner and outer coats of the peridium. It forms a closer connection between the Phalloideæ and the Lycoperdaceæ than has hitherto been known.

1.—PHALLOGASTER SACCATUS, Morgan, n. sp.

Fetid, single or cæspitose, often several arising from an abundant slender, white, fibrous, branching mycelium. Peridium obovoid, usually tapering below, thick, tough-fleshy, the surface smooth and glabrous, glaucous-pink or flesh-color; rupturing by the gradual decay of the wall. The interior of the peridium is at first filled above by the gleba, below by a white floccose substance, both are transformed into mucus upon the maturity of the spores. The gleba consists of numerous green lobes, or masses, sometimes quite distinct from each other, seated on the white glairy inner wall of the peridium. Spores abundant, floating in the mucus, transparent and colorless under the microscope, linear-oblong, 4–5 x 1.5 mic.

Growing singly or in clusters of three or four attached to the same stringy mycelium, which penetrates the rotten wood of an old stick or trunk. Peridium 1–2 inches in height and ½–1 inch in diameter. I observed upon the fibers of the mycelium abundant crystals of calcium oxalate, as figured by DeBary on the mycelial strands of *Phallus caninus*.

The peculiar phalloid odor is not so powerful as in other members of the family.



Phallogaster saccatus, Morgan. n. sp.

EXPLANATION OF PLATE III.

Fig. 1.— Licea biforis, Morgan, n. sp.

Figs. 2, 3, 4.— Diagrammatic representation of the structure of Tubulina.

Fig. 5.— Lycogola conicum, Pers., natural size.

Fig. 6.— Lycogola exigum, Morgan, n. sp., natural size.

Fig. 7 — Lycogola epidendrum, Buxb., natural size.

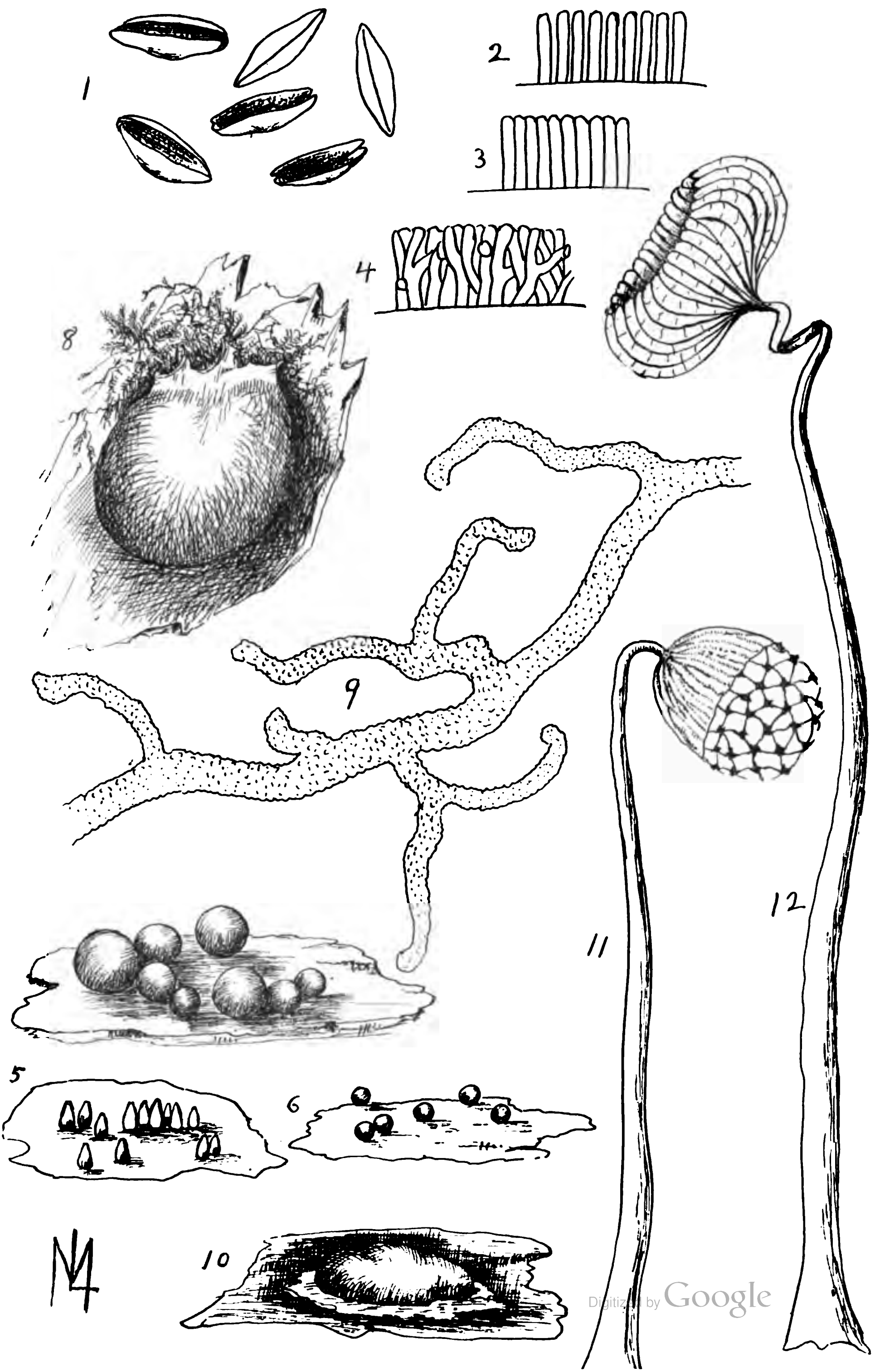
Fig. 8.— Lycogola flavofuscum, Ehr., natural size.

Fig. 9.— Portion of tubule of Lycogola flavofuscum.

Fig. 10.— Reticularia splendens, Morgan, n. sp., natural size.

Fig. 11.— Cribraria cuprea, Morgan, n. sp.

Fig. 12.— Dictydium longipes, Morgan, n. sp.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